Compliance Testing, LLC
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Test Report

Prepared for: Cellphone-Mate Inc.

Model: CM TriFlex-A

Description: 3-Band Cellphone Signal Booster

FCC ID: RSNTRIFLEX-A

To

FCC Part 20

Date of Issue: December 3, 2013

On the behalf of the applicant:	**Cellphone-Mate Inc.** **48346 Milmont Drive** **Fremont, CA 94538**
To the attention of:	**Hongtao Zhan, CEO** **Ph: (510) 770-0469** **Email: hzhan@cellphone-mate.com**

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Project No: p1370008

Greg Corbin

Greg Corbin
Project Test Engineer

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All results contained herein relate only to the sample tested.

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	December 3, 2013	Greg Corbin	Original Document
2.0	December 17,2013	Greg Corbin	Revised test data to show at least 2 points in the RSSI dependent region for Variable Noise and Variable Gain tests on pages 50, 51, 61.
3.0	December 20, 2013	Amanda Reed	Corrected Model name
4.0	January 3, 2014	Greg Corbin	Corrected MSCL in the variable gain tables on page 61 to match final MSCL document submitted by manufacturer.
5.0	January 28, 2014	Greg Corbin	Corrected rule sections in the test summary table for conducted spurious, Noise Limits, and Uplink Inactivity on page 7.
6.0	February 3, 2014	Amanda Reed	Corrected FCC ID

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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

FCC OATS Reg, #349717

IC Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

Test and Measurement Data
Subpart
2.1033(c)(14):

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Part 2, Subpart J and the following individual Parts: 20.21 in conjunction with latest version of KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516.

Standard Test Conditions and Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI/C63.4-2009, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F), unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Environmental Conditions		
Temp (ºC)	**Humidity (%)**	**Pressure (mbar)**
24.2 – 26.9	32.3 – 43.1	970

Measurement results, unless otherwise noted, are worst-case measurements.

EUT Description
Model: CM TriFlex-A
Description: 3-Band Cellphone Signal Booster
Firmware: N/A
Software: Revision 2.0
Additional Information:

The EUT is an **In Building** bi-directional amplifier for the boosting of cellular phone signals and data communication devices.
The following frequency bands and emission types are utilized.

Frequency Band (MHz)			
Uplink	698 - 716	824 - 849	1850 - 1910
Downlink	728 - 746	869 - 894	1930 - 1990
Modulation Type	LTE	GSM, CDMA, EDGE, HSPA. EVDO, LTE	CDMA, HSPA, LTE, EDGE, EVDO

Emission Designators					
CDMA	**HSPA**	**LTE**	**EVDO**	**EDGE**	**GSM**
F9W	F9W	G7D	F9W	G7W	GXW

The modulation types and emission designators listed in the tables represent the modulations that the cell phone providers use for each frequency band. GSK, CDMA, and WCDMA represent all the modulation types (phase and amplitude or a combination thereof) utilized within the industry. EDGE, HSPA, LTE etc. are all protocols or multiplexing techniques using the base modulations.

EUT Operation during Tests
The EUT was in a normal operating condition.
The EUT is powered by a 120 vac to +9 vdc wall adapter.

Accessories:

Qty	Description	Mfg	Model	S/N
1	I.T.E. Power Supply	Surecall	GFP451DA-0945-1	N/A

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
20.21(e)(3)	Authorized Frequency Band	Pass	
20.21(e)(8)(i)(B) 20.21(e)(8)(i)(C) 20.21(e)(8)(i)(D)	Maximum Power and Gain	Pass	
20.21(e)(8)(i)(F)	Intermodulation	Pass	
20.21(e)(8)(i)(E)	Out-of-Band Emissions	Pass	
2.1051 22.917(a) 24.238((a) 27.53(f)	Conducted Spurious Emissions	Pass	
20.21(e)(8)(i)(A)	Noise Limits	Pass	
20.21(e)(8)(i)(I)	Uplink Inactivity	Pass	
21(e)(8)(i)(C)	Variable Gain	Pass	
2.1049	Occupied Bandwidth	Pass	
20.21(e)(8)(ii)(A)	Oscillation Detection	Pass	
2.1053	Radiated Spurious	Pass	
20.21(e)(8)(i)(B)	Spectrum Block Filtering	N/A	This only applies to devices utilizing spectrum block filtering

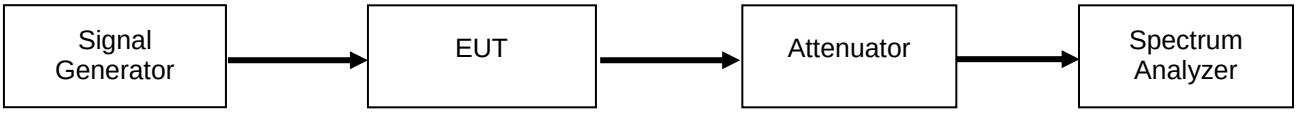
Authorized Frequency Band

Name of Test:	Authorized Frequency Band	**Engineer:** Greg Corbin
Test Equipment Utilized:	i00424, SMU 200A - S/N:101369	**Test Date:** 11/22/2013

Test Procedure

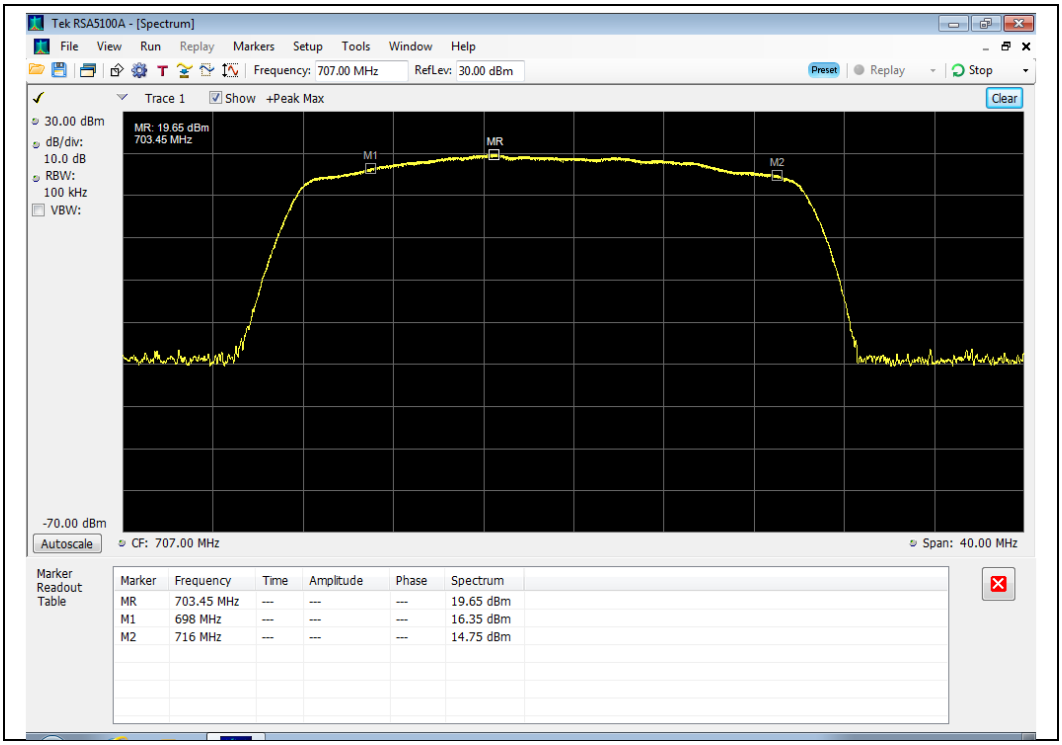
The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings. A signal generator was utilized to produce a CW input signal tuned to the center channel of the operational band. The RF input level was increased to a point just prior to the AGC being in control of the power. The Signal generator was set to sweep across 2X the operational band of the EUT while the spectrum analyzer was set to MAX HOLD. Two markers were placed at the edges of the operational band and a third marker was placed at the highest point within the band no closer than 2.5 MHz from the band edge.

Test Setup

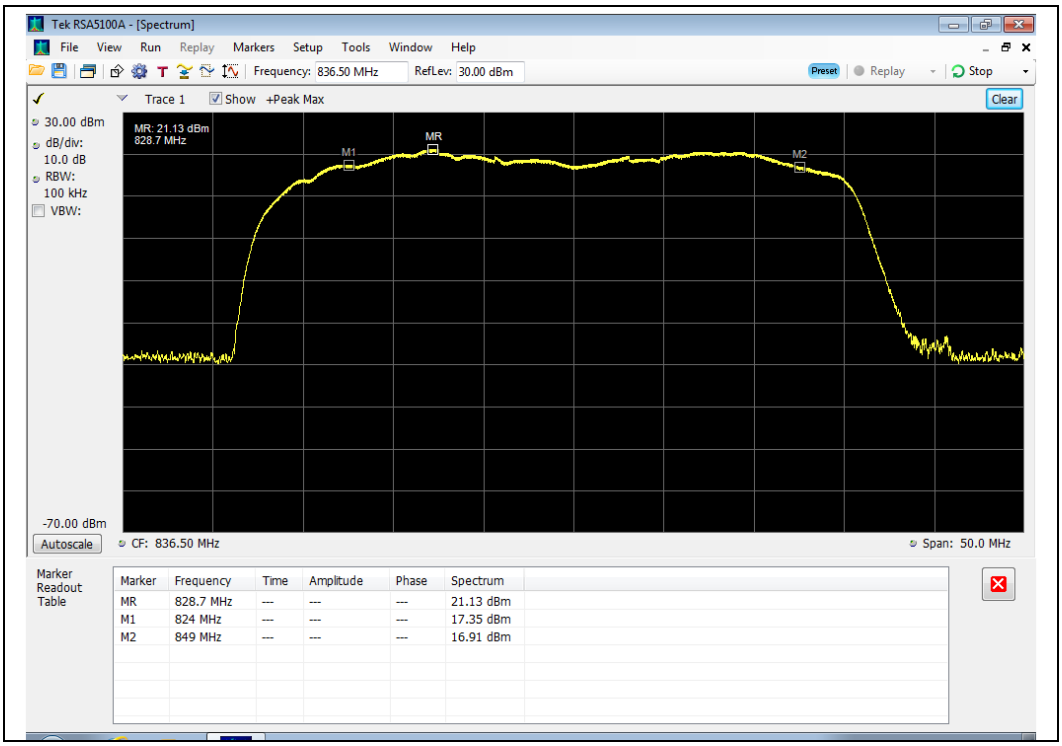


Uplink Test Results

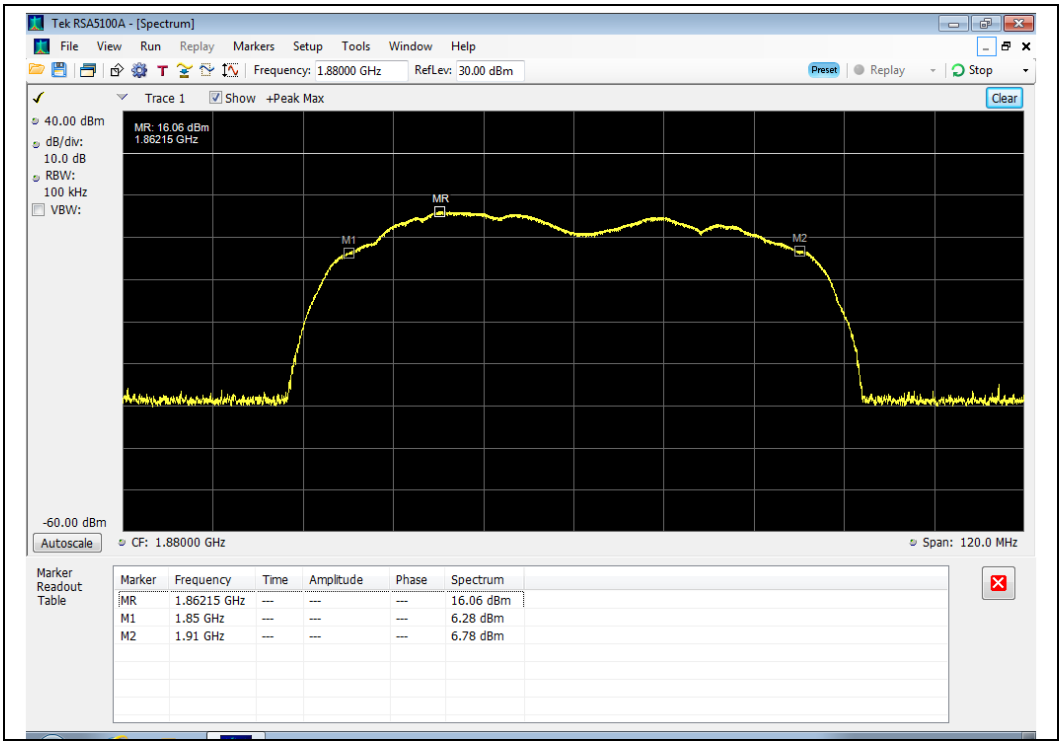
698 - 716 MHz Band



824 - 849 MHz Band

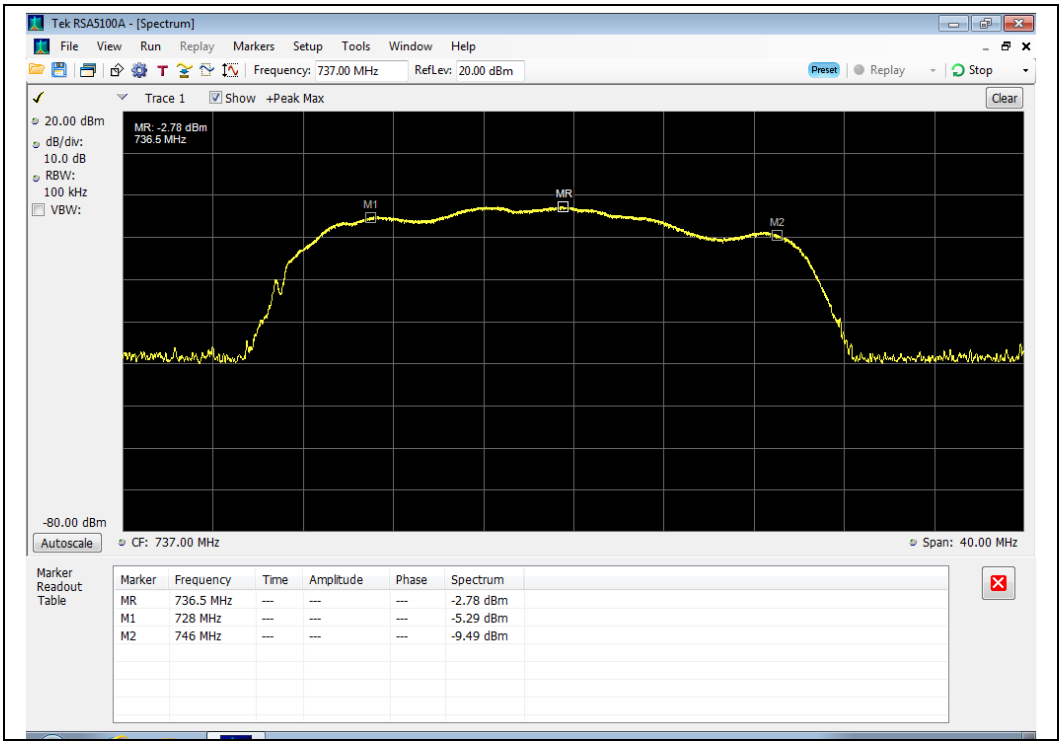


1850 - 1910 MHz Band

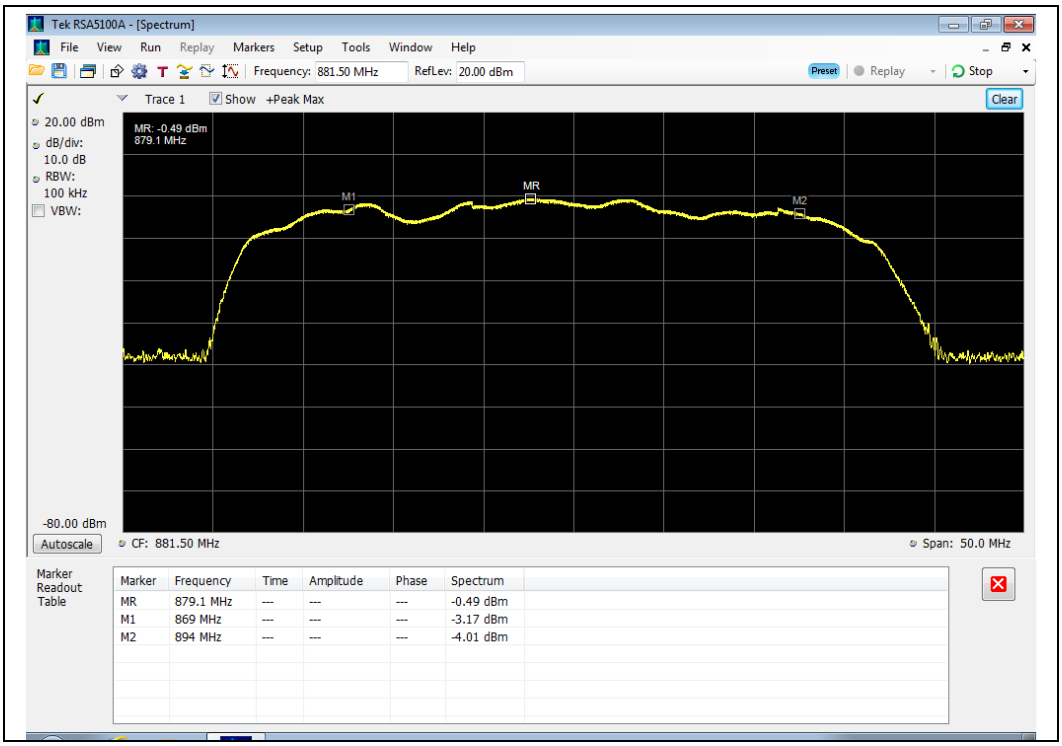


Downlink Test Results

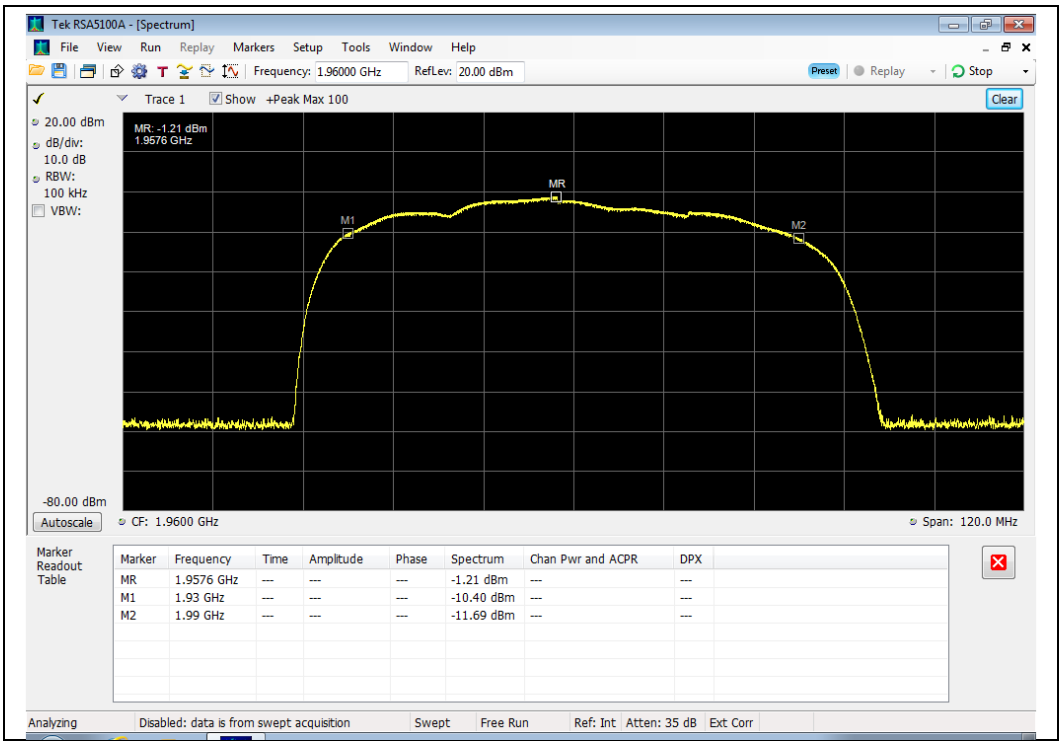
728 - 746 MHz Band



869 - 894 MHz Band



1930 - 1990 MHz Band



Maximum Power and Gain

Name of Test:	Maximum Power and Gain	**Engineer:** Greg Corbin
Test Equipment Utilized:	i00424, SMU 200A - S/N:101369	**Test Date:** 11/22/2013

Test Procedure

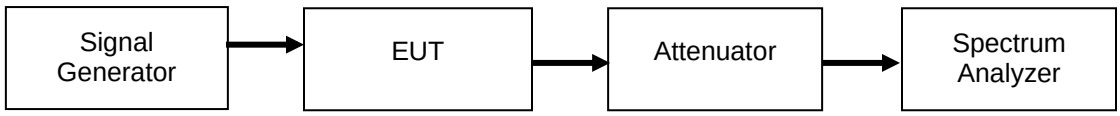
The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings. The spectrum analyzer and signal generator were tuned to the frequency with the highest power level in the band, as determined by the Authorized Frequency Band test. The RF input level was increased to a point just prior to the AGC being in control of the power for both pulsed single time slot GSM modulation and 4.1 MHz AWGN modulation. The maximum power was measured and verified to meet the minimum and maximum levels allowed, with the maximum gain being computed from these values. The uplink and downlink gain under each condition were verified to be within 9 dB of each other.

The following formula was used for calculating the gain limits.

Gain Limit (dB) = 6.5 dB + 20Log(F_{MHz})

F_{MHz} is the uplink mid-band frequency with the downlink gain limit being equivalent to the paired Uplink band gain limit.

Test Setup



Uplink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Lower Limit (dBm)	Upper Limit (dBm)	Result
698 - 716 MHz Pulsed GSM	-40.7	19.7	17	30	Pass
698 - 716 MHz AWGN	-43.1	18.1	17	30	Pass
824 - 849 MHz Pulsed GSM	-40.0	20.1	17	30	Pass
824 - 849 MHz AWGN	-43.1	18.6	17	30	Pass
1850 - 1910 MHz Pulsed GSM	-41.3	25.0	17	30	Pass
1850 - 1910 MHz AWGN	-44.9	22.6	17	30	Pass

Downlink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Upper Limit (dBm)	Result
728 - 746 MHz Pulsed GSM	-61.7	-2.5	17	Pass
728 - 746 MHz AWGN	-65.4	-5.1	17	Pass
869 - 894 MHz Pulsed GSM	-61.3	-0.8	17	Pass
869 - 894 MHz AWGN	-65.3	-3.7	17	Pass
1930 - 1990 MHz Pulsed GSM	-67.2	-1.8	17	Pass
1930 - 1990 MHz AWGN	-70.4	-4.4	17	Pass

Uplink and Downlink Gain Test Results

Modulation	Uplink Frequency (MHz)	Downlink Frequency (MHz)	Uplink Gain (dB)	Uplink Limit (dB)	Downlink Gain (dB)	Downlink Limit (dB)	Delta (dB)	Limit (dB)	Margin (dB)
Pulsed GSM	703.45	736.5	60.4	63.5	59.2	63.5	1.2	9	-7.8
AWGN	703.45	736.5	61.2	63.5	60.3	63.5	0.9	9	-8.1
Pulsed GSM	828.7	879.1	60.1	64.9	60.5	64.9	0.4	9	-8.6
AWGN	828.7	879.1	61.7	64.9	61.6	64.9	0.1	9	-8.9
Pulsed GSM	1862.15	1957.6	66.3	72	65.4	72	0.9	9	-8.1
AWGN	1862.15	1957.6	67.5	72	66.0	72	1.5	9	-7.5

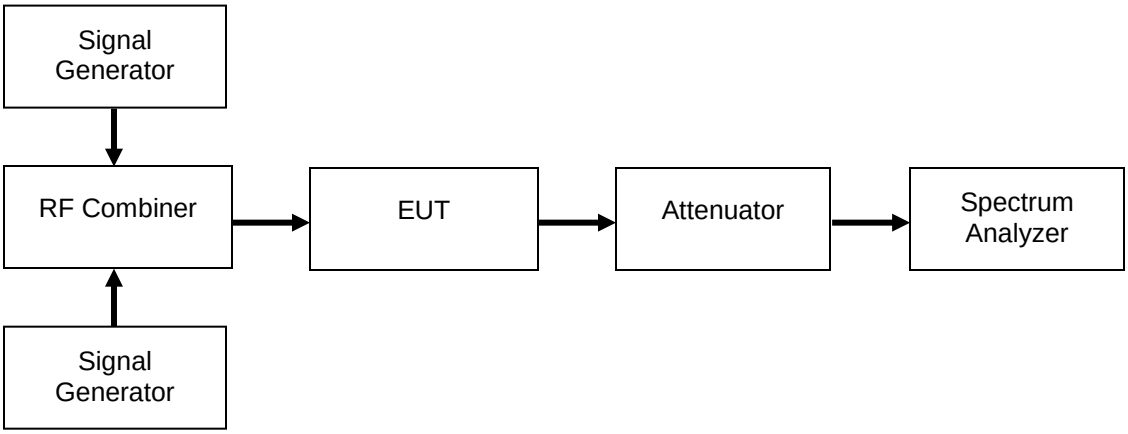
Intermodulation

Name of Test: Intermodulation **Engineer:** Greg Corbin
Test Equipment Utilized: i00424, SMU 200A - S/N:101369 **Test Date:** 11/25/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator. Two signal generators were utilized to produce two CW signals 600 kHz apart and centered in the operational band. Attenuator and cable insertion loss correction factors were input to either the signal generator or the spectrum analyzer as required to ensure that accurate measurements were recorded. The input power was set at the maximum allowable power and the RMS intermodulation products were measured to ensure they were less than -19 dBm in a 3 kHz RBW. The uplink and downlink intermodulation products were plotted, with the levels being listed in the summary tables.

Test Setup



Uplink Test Results

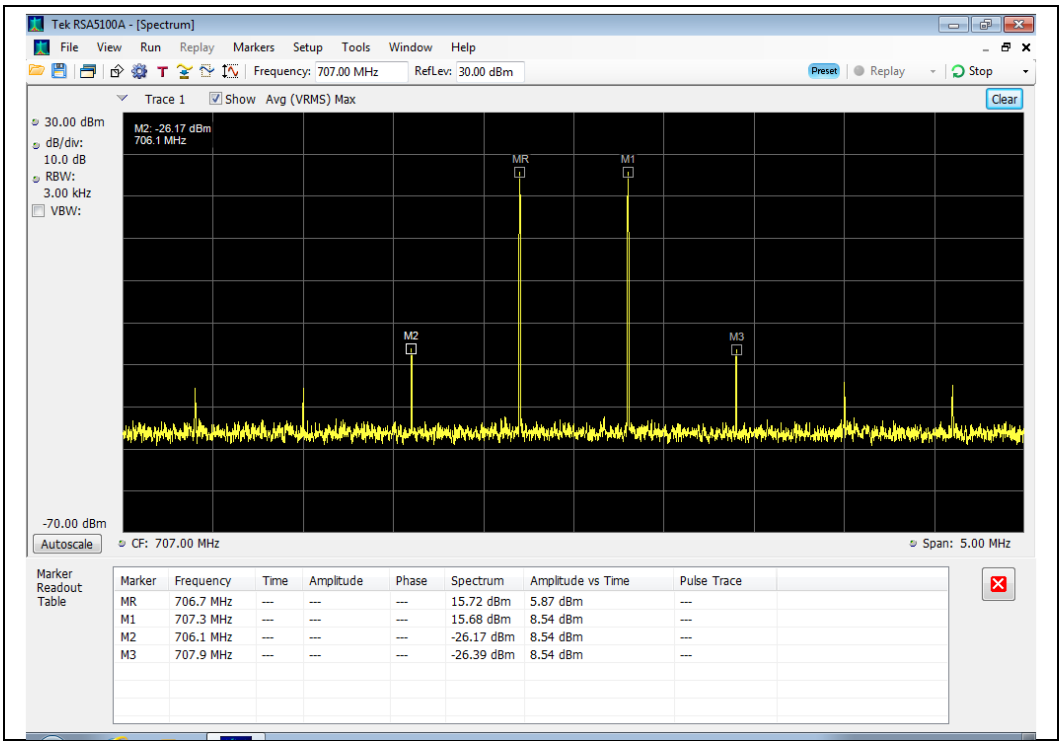
Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
698 - 716 MHz	-26.2	-19	Pass
824 - 849 MHz	-23.7	-19	Pass
1850 - 1910 MHz	-22.4	-19	Pass

Downlink Test Results

Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
728 - 746 MHz	-57.3	-19	Pass
869 - 894 MHz	-57.8	-19	Pass
1930 - 1990 MHz	-53.4	-19	Pass

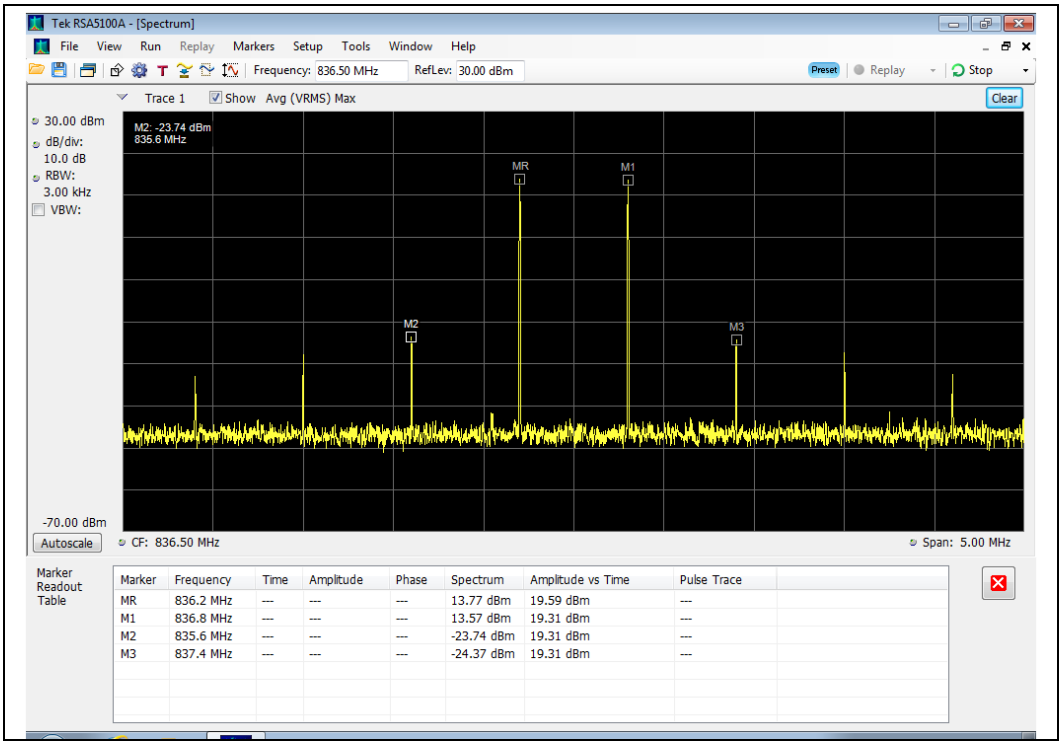
Uplink Test Results

698 - 716 MHz Band



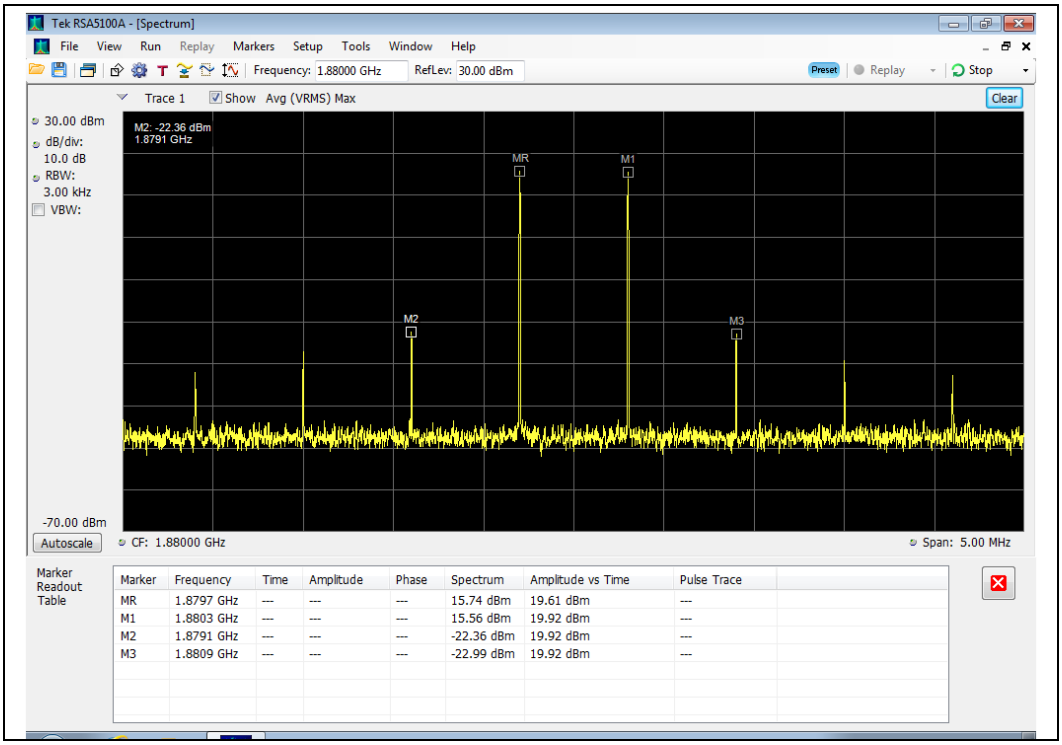
Marker	Frequency	Time	Amplitude	Phase	Spectrum	Amplitude vs Time	Pulse Trace
MR	706.7 MHz	---	---	---	15.72 dBm	5.87 dBm	---
M1	707.3 MHz	---	---	---	15.68 dBm	8.54 dBm	---
M2	706.1 MHz	---	---	---	-26.17 dBm	8.54 dBm	---
M3	707.9 MHz	---	---	---	-26.39 dBm	8.54 dBm	---

824 - 849 MHz Band



Marker	Frequency	Time	Amplitude	Phase	Spectrum	Amplitude vs Time	Pulse Trace
MR	836.2 MHz	---	---	---	13.77 dBm	19.59 dBm	---
M1	836.8 MHz	---	---	---	13.57 dBm	19.31 dBm	---
M2	835.6 MHz	---	---	---	-23.74 dBm	19.31 dBm	---
M3	837.4 MHz	---	---	---	-24.37 dBm	19.31 dBm	---

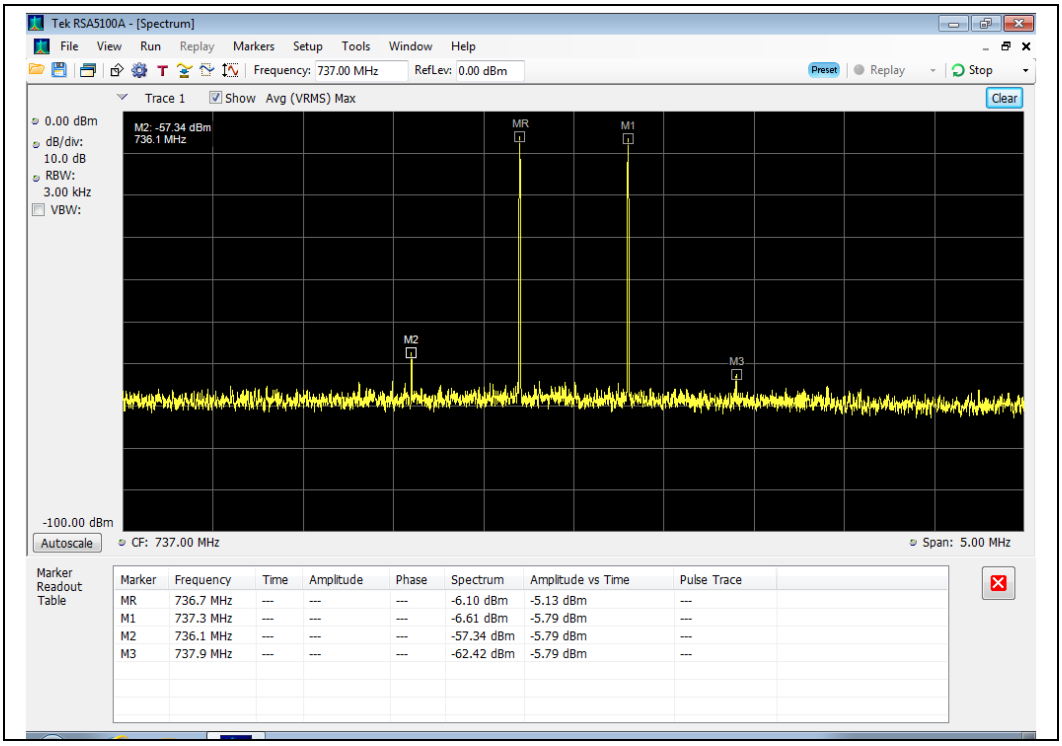
1850 - 1910 MHz Band



Marker	Frequency	Time	Amplitude	Phase	Spectrum	Amplitude vs Time	Pulse Trace
MR	1.8797 GHz	---	---	---	15.74 dBm	19.61 dBm	---
M1	1.8803 GHz	---	---	---	15.56 dBm	19.92 dBm	---
M2	1.8791 GHz	---	---	---	-22.36 dBm	19.92 dBm	---
M3	1.8809 GHz	---	---	---	-22.99 dBm	19.92 dBm	---

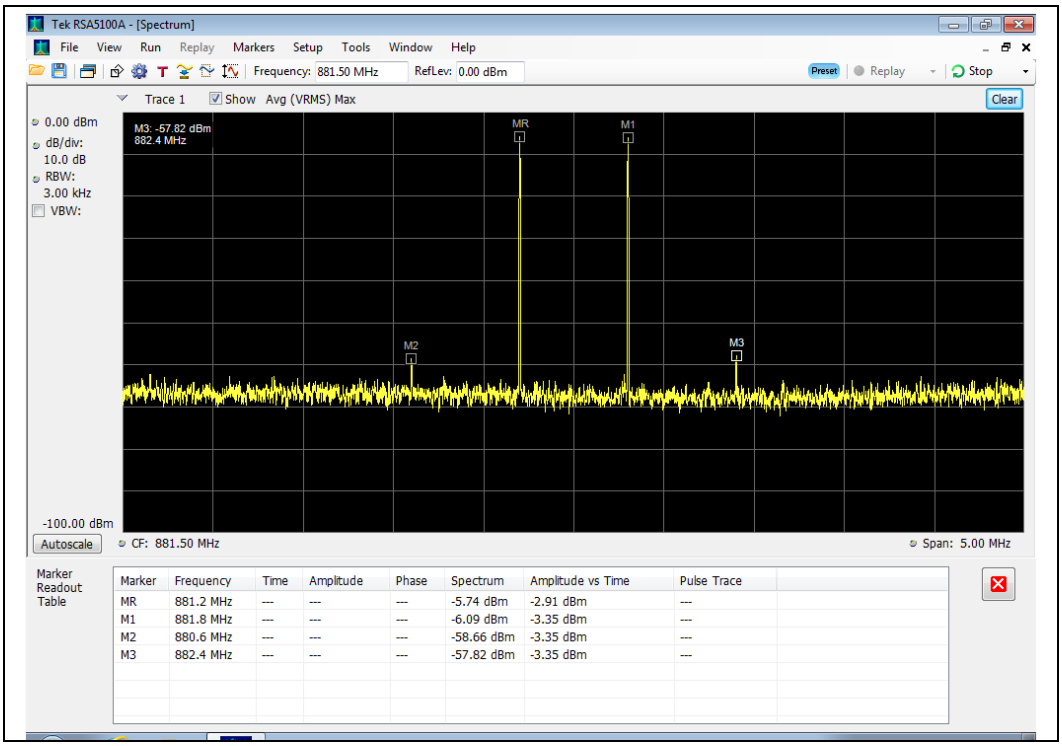
Downlink Test Results

728 - 746 MHz Band



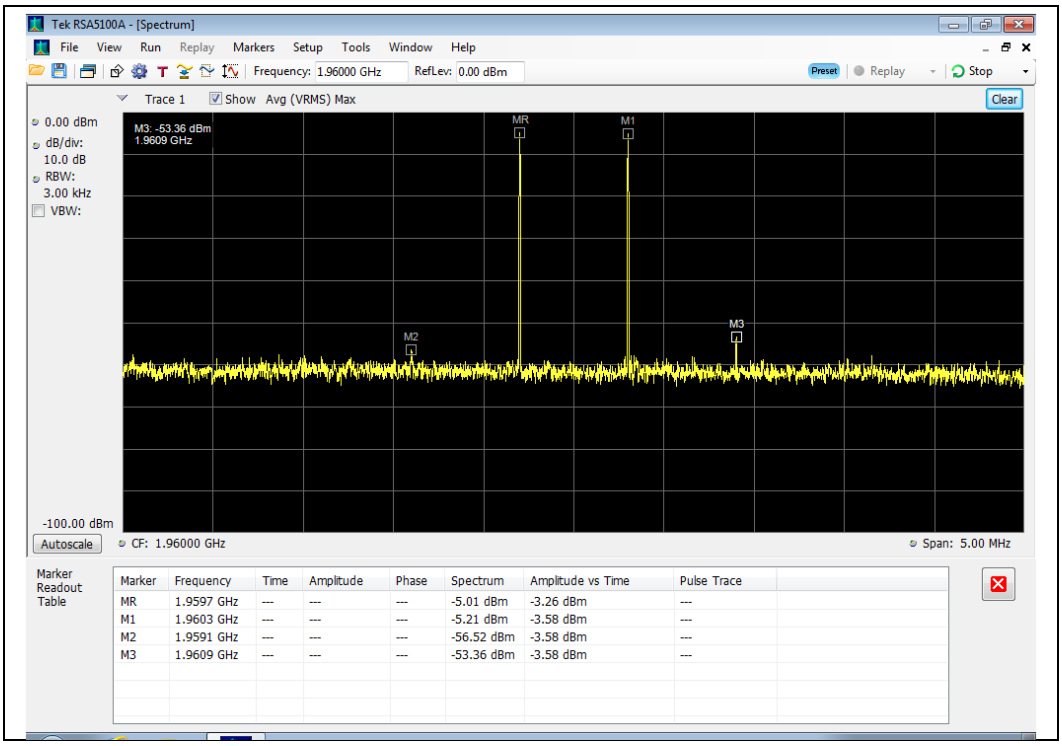
Marker	Frequency	Time	Amplitude	Phase	Spectrum	Amplitude vs Time	Pulse Trace
MR	736.7 MHz	---	---	---	-6.10 dBm	-5.13 dBm	---
M1	737.3 MHz	---	---	---	-6.61 dBm	-5.79 dBm	---
M2	736.1 MHz	---	---	---	-57.34 dBm	-5.79 dBm	---
M3	737.9 MHz	---	---	---	-62.42 dBm	-5.79 dBm	---

869 - 894 MHz Band



Marker	Frequency	Time	Amplitude	Phase	Spectrum	Amplitude vs Time	Pulse Trace
MR	881.2 MHz	---	---	---	-5.74 dBm	-2.91 dBm	---
M1	881.8 MHz	---	---	---	-6.09 dBm	-3.35 dBm	---
M2	880.6 MHz	---	---	---	-58.66 dBm	-3.35 dBm	---
M3	882.4 MHz	---	---	---	-57.82 dBm	-3.35 dBm	---

1930 - 1990 MHz Band



Marker	Frequency	Time	Amplitude	Phase	Spectrum	Amplitude vs Time	Pulse Trace
MR	1.9597 GHz	---	---	---	-5.01 dBm	-3.26 dBm	---
M1	1.9603 GHz	---	---	---	-5.21 dBm	-3.58 dBm	---
M2	1.9591 GHz	---	---	---	-56.52 dBm	-3.58 dBm	---
M3	1.9609 GHz	---	---	---	-53.36 dBm	-3.58 dBm	---

Out-of-Band Emissions

Name of Test:	Out-of-Band Emissions	**Engineer:** Greg Corbin
Test Equipment Utilized:	i00424, SMU 200A - S/N:101369	**Test Date:** 11/26/2013

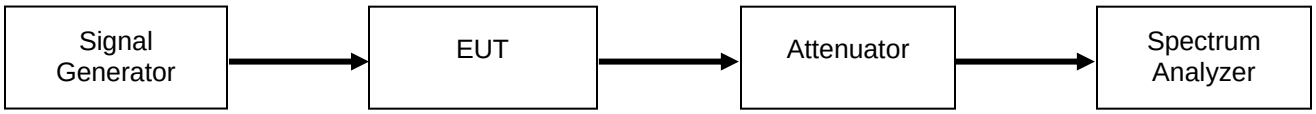
Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings. A signal generator was utilized to produce the following signals; GSM, CDMA, and WCDMA. The signal generator was tuned to the lowest allowable upper and lower channel within the EUT operational band for each respective modulation type. The RF input level was increased to a point just prior to the AGC being in control of the power. For each modulation type the Out of Band Emissions were measured to ensure they met the limits.

The following formula was used for calculating the limits:

Limit = P1 - 6 (43+ 10Log(P2)) = -19dBm
where P1 = power in dBm and P2 = power in Watts

Test Setup



GSM Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-35.8	-19	Pass
698 - 716	Upper	-34.6	-19	Pass
824 - 849	Lower	-44.1	-19	Pass
824 - 849	Upper	-44.2	-19	Pass
1850 - 1910	Lower	-45.3	-19	Pass
1850 - 1910	Upper	-76.9	-19	Pass

CDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-50.7	-19	Pass
698 - 716	Upper	-51	-19	Pass
824 - 849	Lower	-43.4	-19	Pass
824 - 849	Upper	-40.8	-19	Pass
1850 - 1910	Lower	-45.8	-19	Pass
1850 - 1910	Upper	-67.2	-19	Pass

WCDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-53.8	-19	Pass
698 - 716	Upper	-56.1	-19	Pass
824 - 849	Lower	-42	-19	Pass
824 - 849	Upper	-40.3	-19	Pass
1850 - 1910	Lower	-41.4	-19	Pass
1850 - 1910	Upper	-59	-19	Pass

GSM Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-55.5	-19	Pass
728 - 746	Upper	-57.8	-19	Pass
869 - 894	Lower	-63.2	-19	Pass
869 - 894	Upper	-64.4	-19	Pass
1930 - 1990	Lower	-68.9	-19	Pass
1930 - 1990	Upper	-79.5	-19	Pass

CDMA Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-65.9	-19	Pass
728 - 746	Upper	-67.8	-19	Pass
869 - 894	Lower	-64.2	-19	Pass
869 - 894	Upper	-64.6	-19	Pass
1930 - 1990	Lower	-64.2	-19	Pass
1930 - 1990	Upper	-69.6	-19	Pass

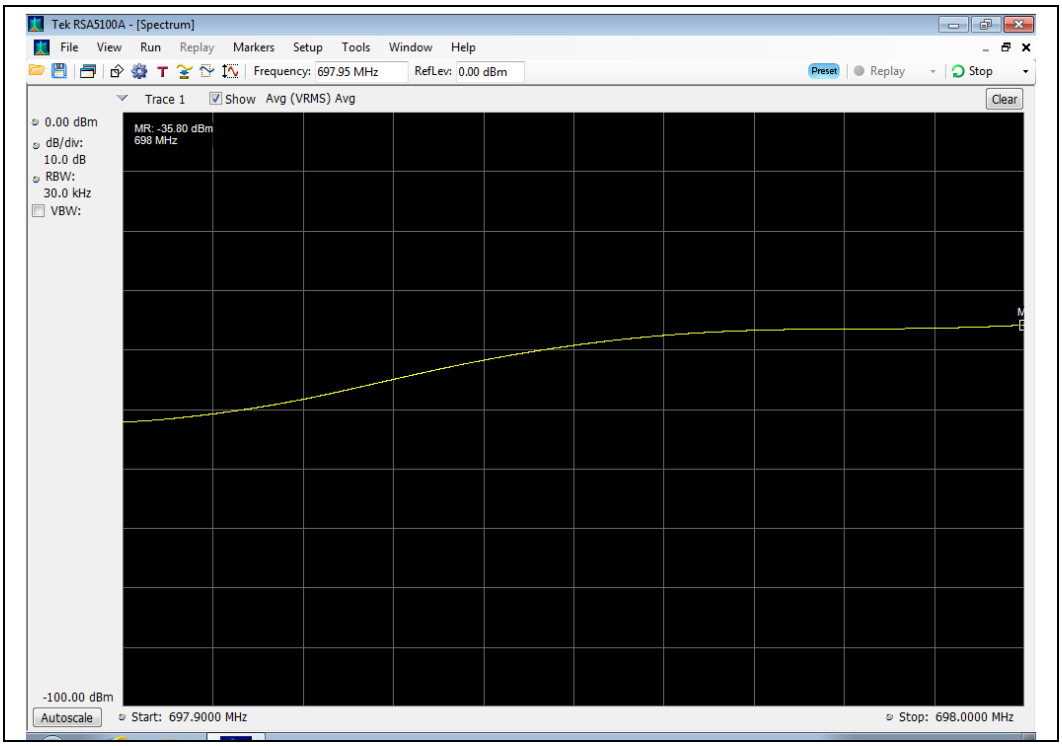
WCDMA Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-65.9	-19	Pass
728 - 746	Upper	-68.2	-19	Pass
869 - 894	Lower	-59.5	-19	Pass
869 - 894	Upper	-59.6	-19	Pass
1930 - 1990	Lower	-59.8	-19	Pass
1930 - 1990	Upper	-64.8	-19	Pass

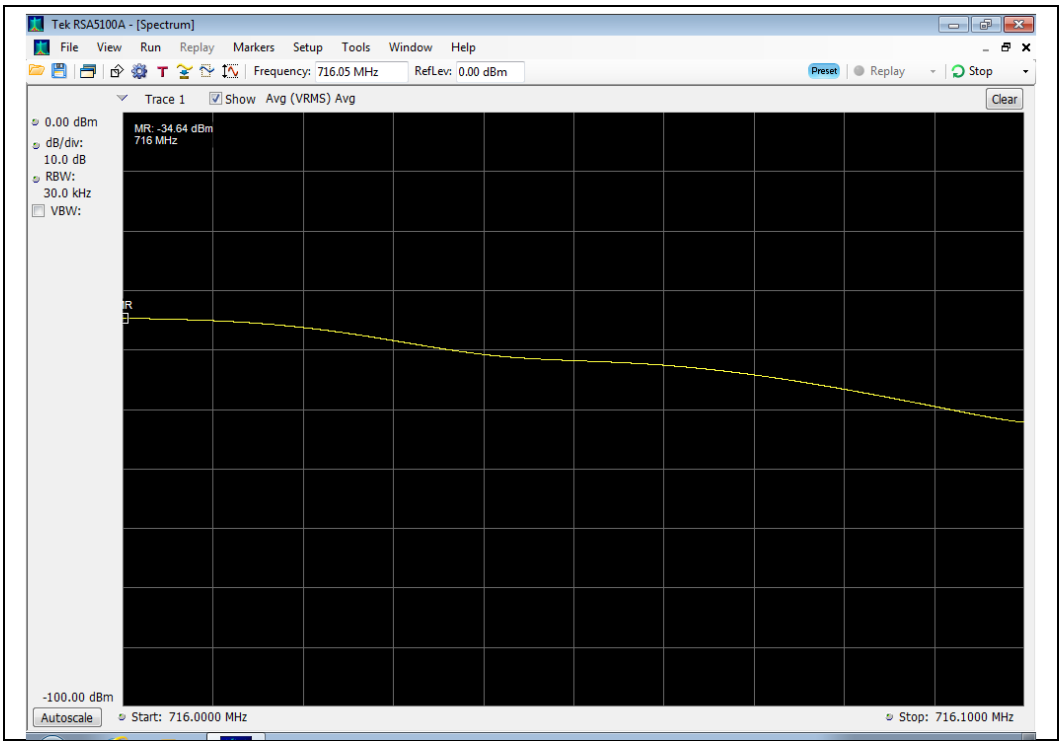
GSM Uplink Test Plots

698 - 716 MHz Band

Lower Band Edge

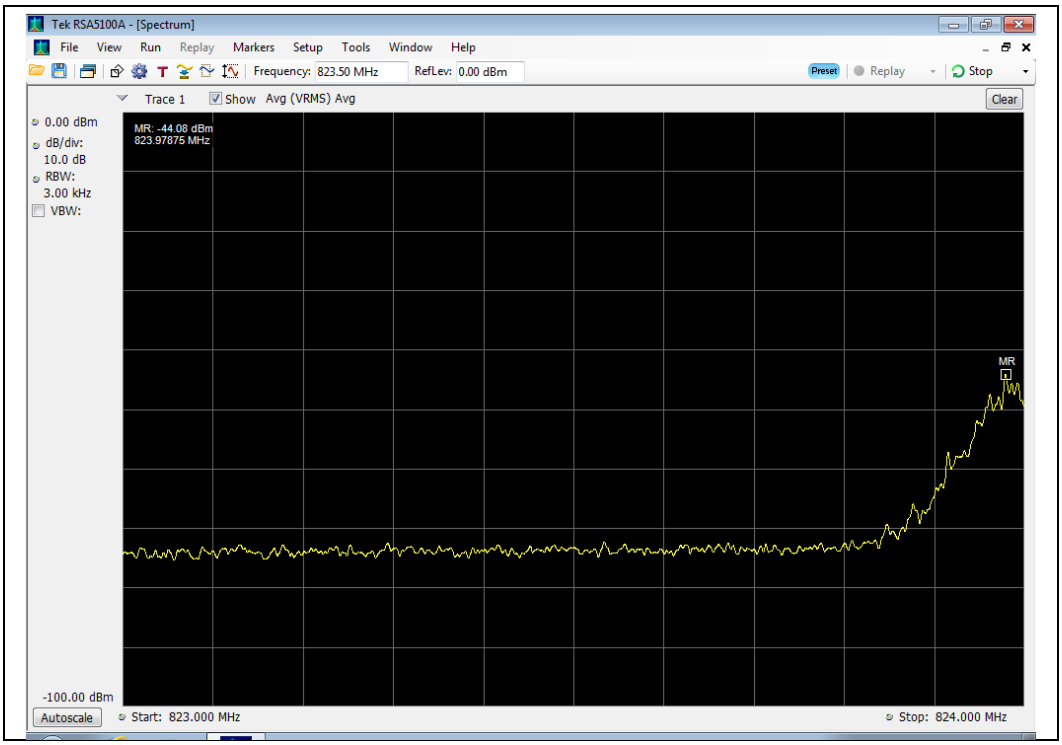


Upper Band Edge

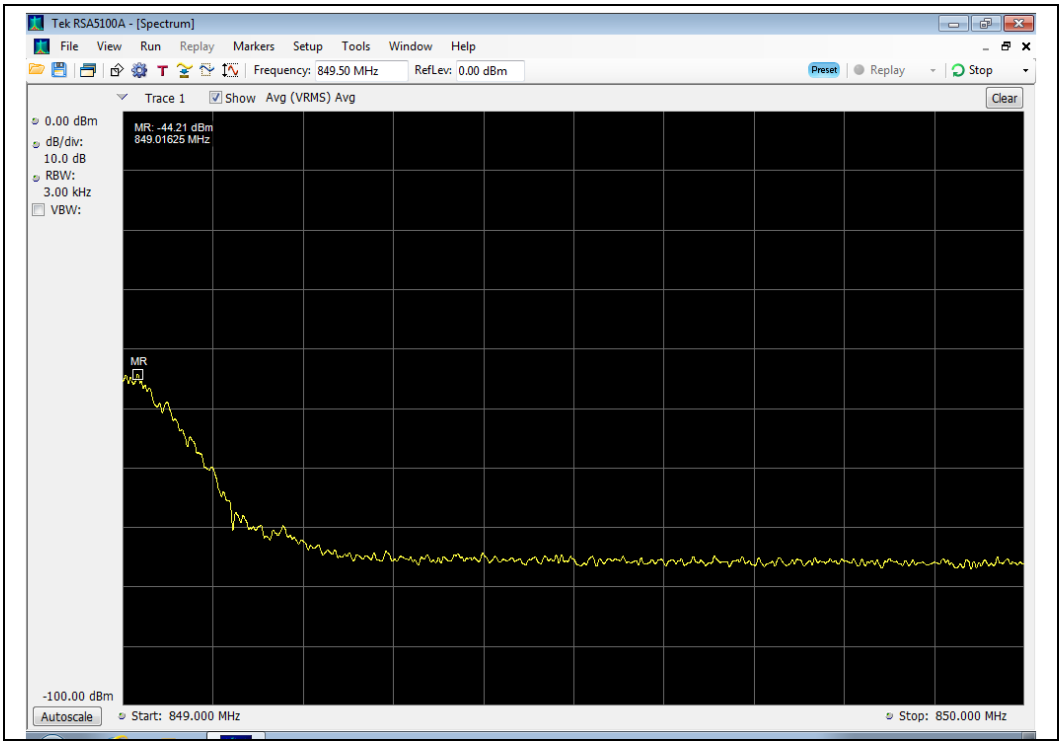


824 - 849 MHz Band

Lower Band Edge

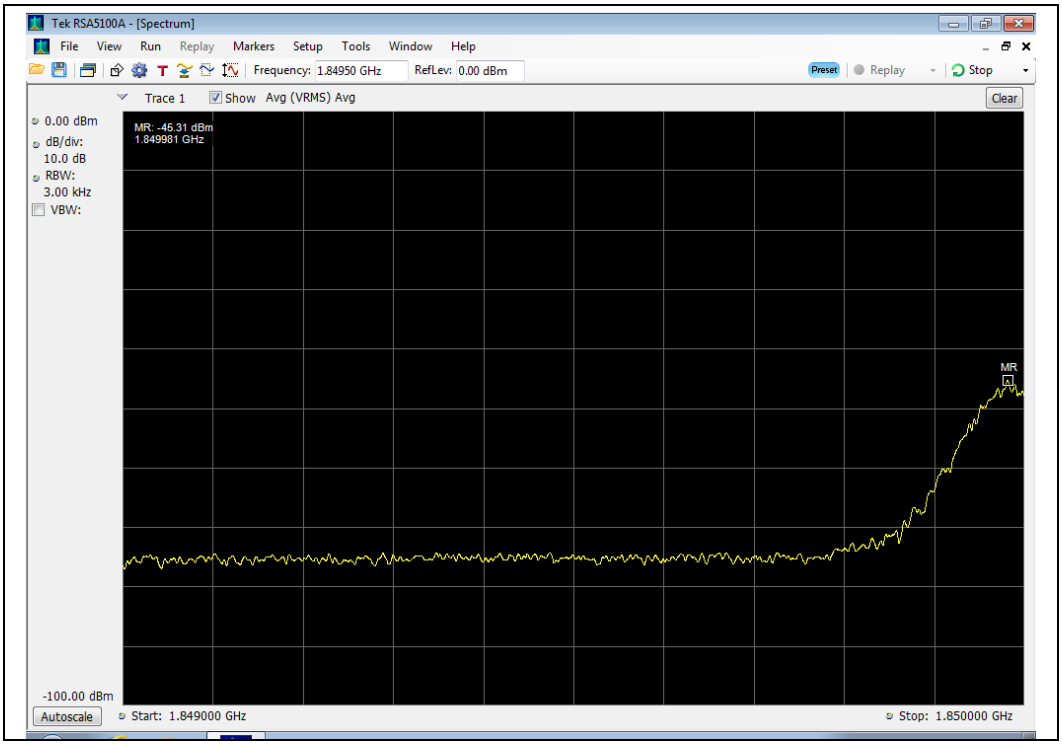


Upper Band Edge

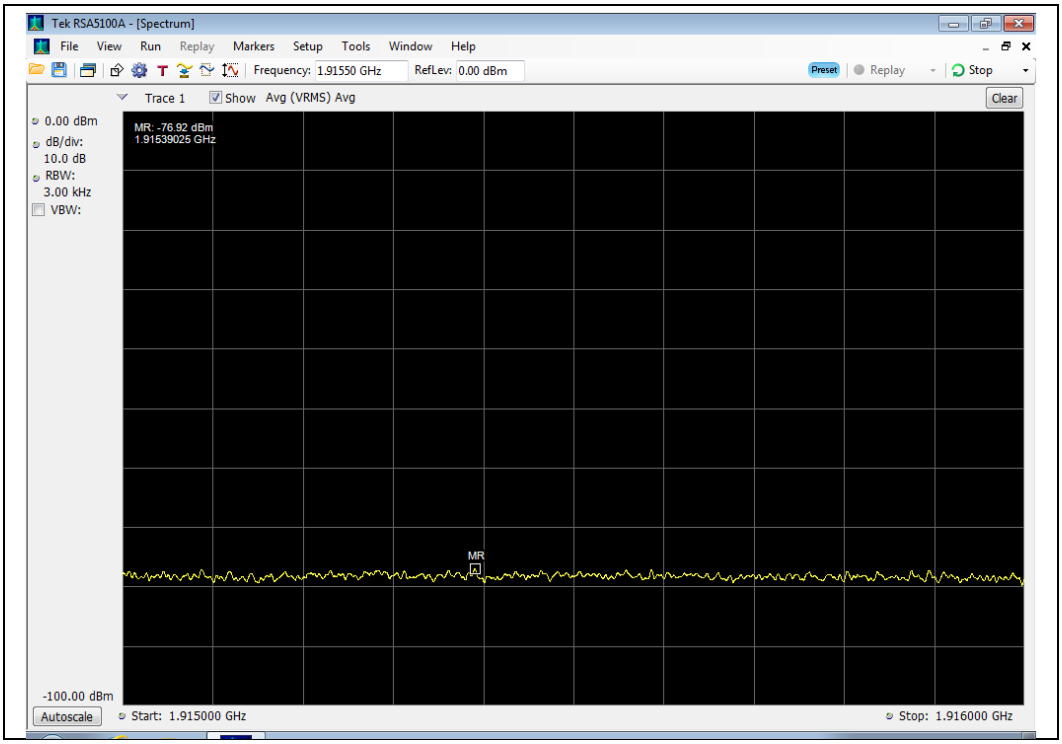


1850 - 1910 MHz Band

Lower Band Edge



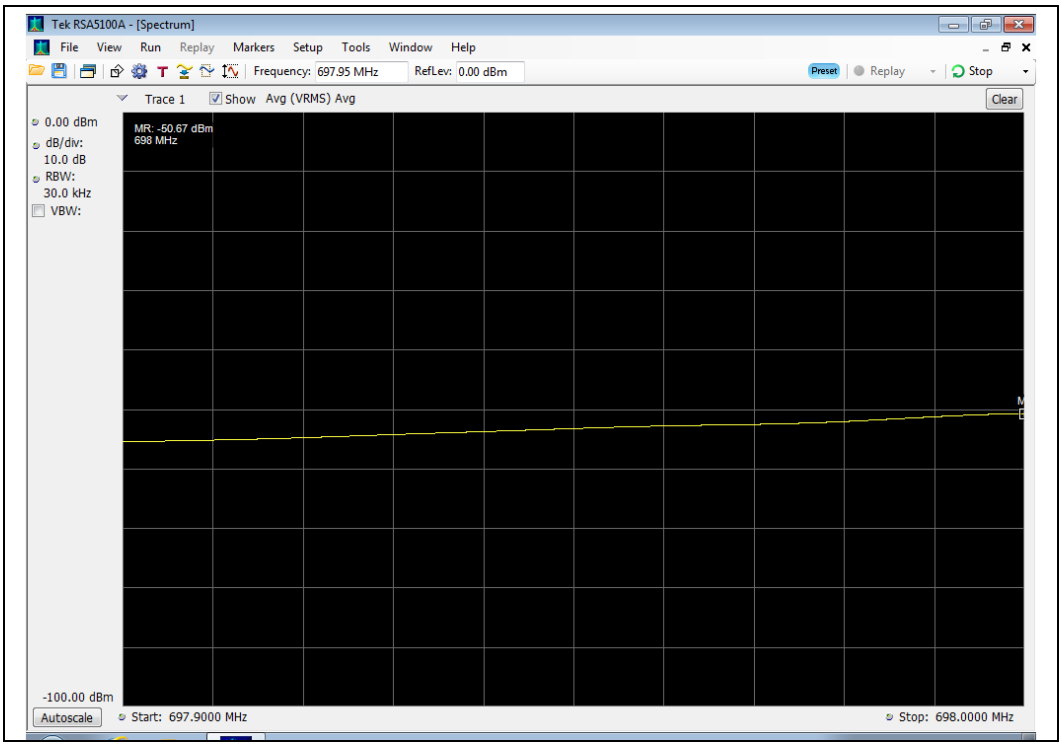
Upper Band Edge



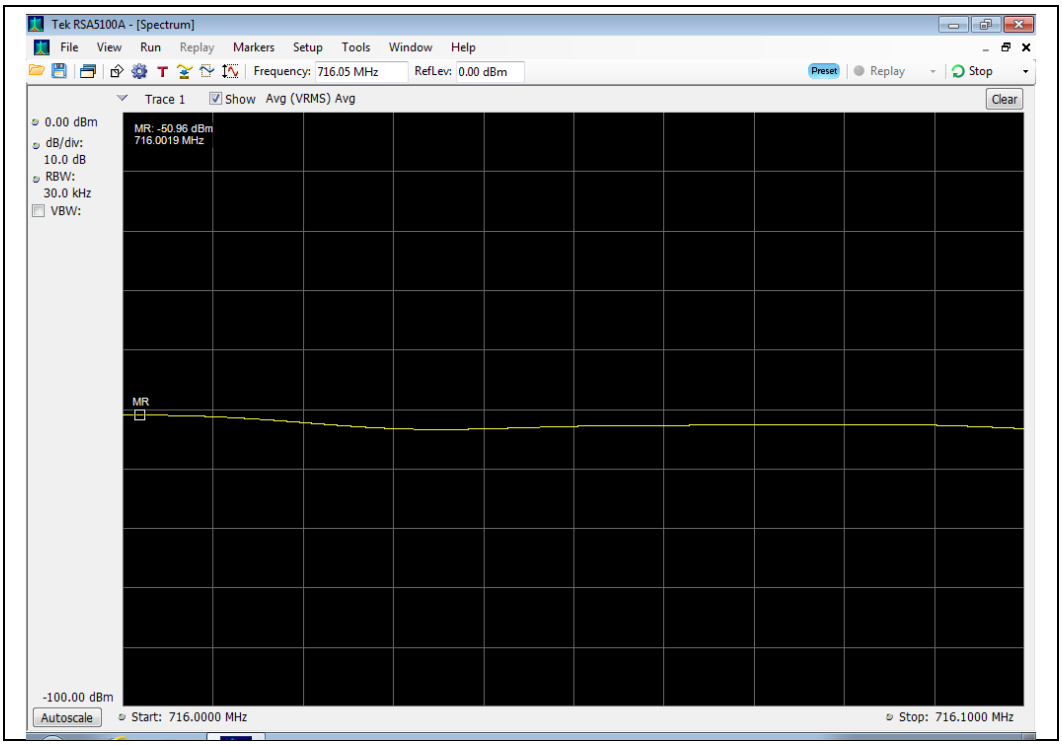
CDMA Uplink Test Plots

698 - 716 MHz Band

Lower Band Edge

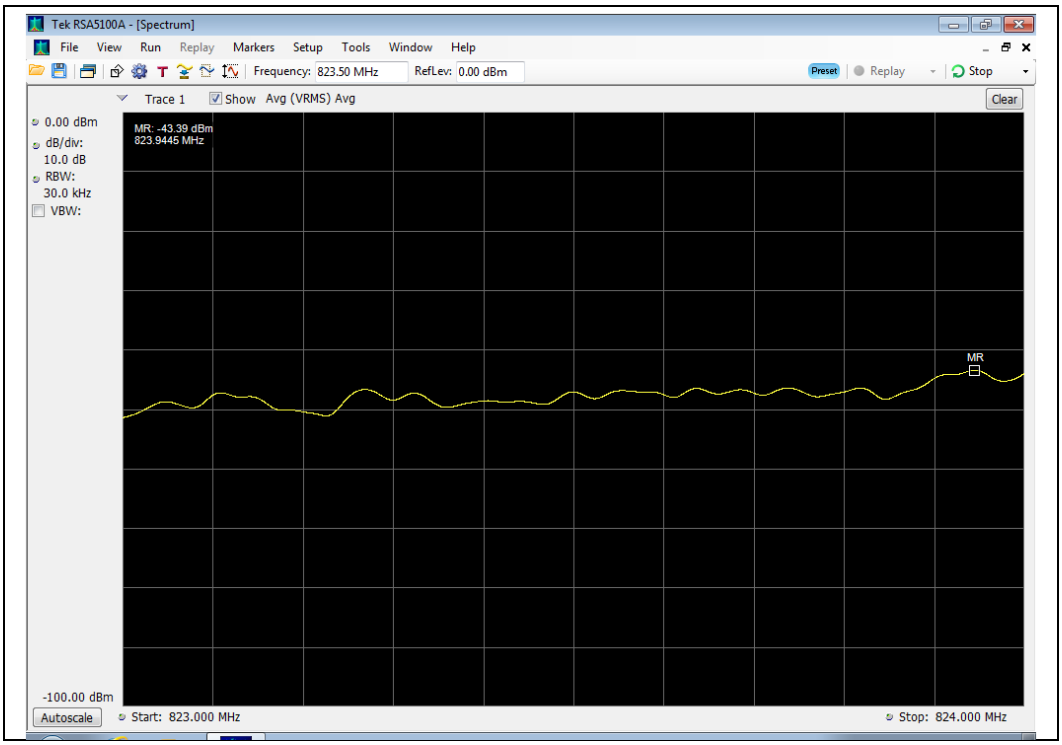


Upper Band Edge

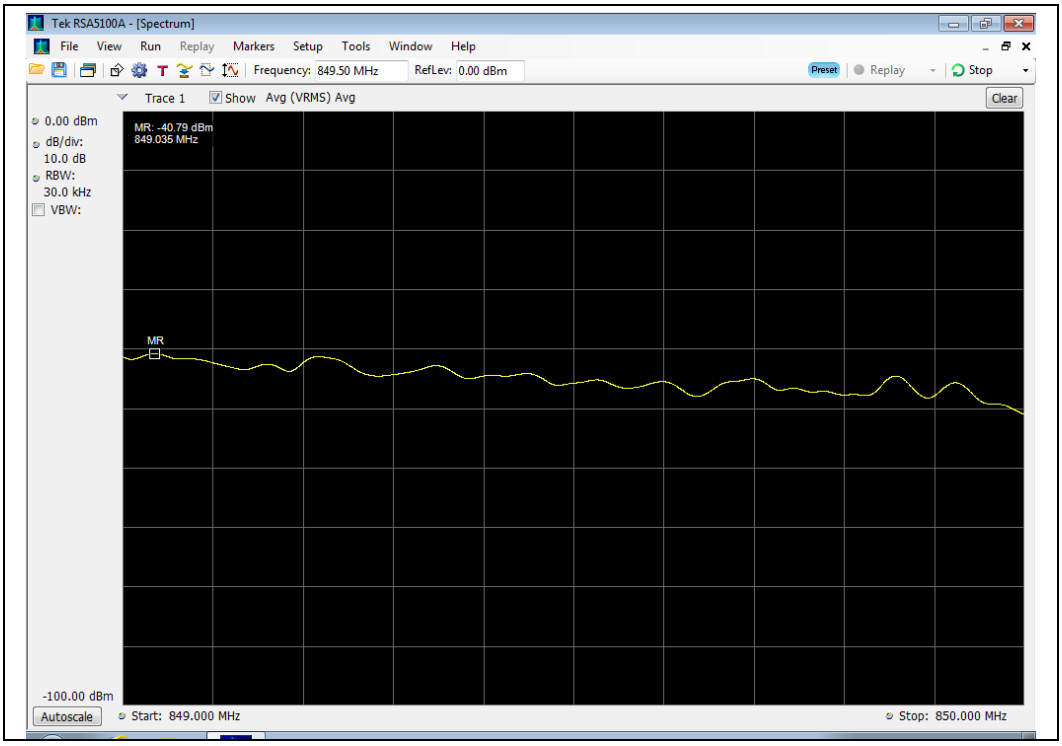


824 - 849 MHz Band

Lower Band Edge

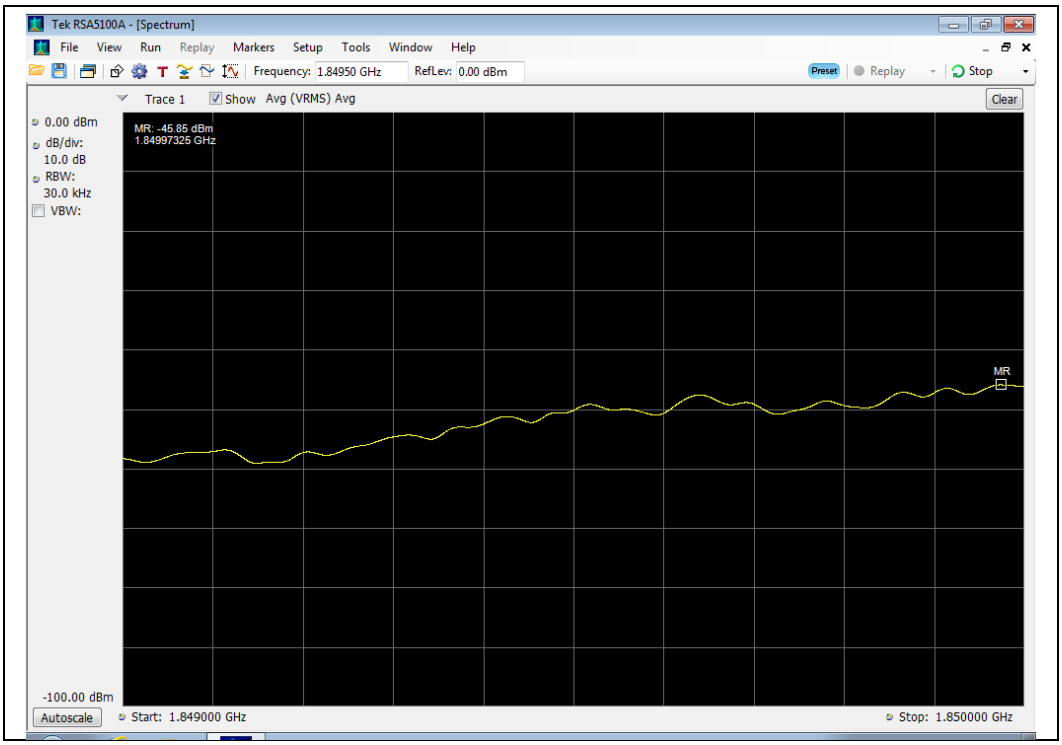


Upper Band Edge

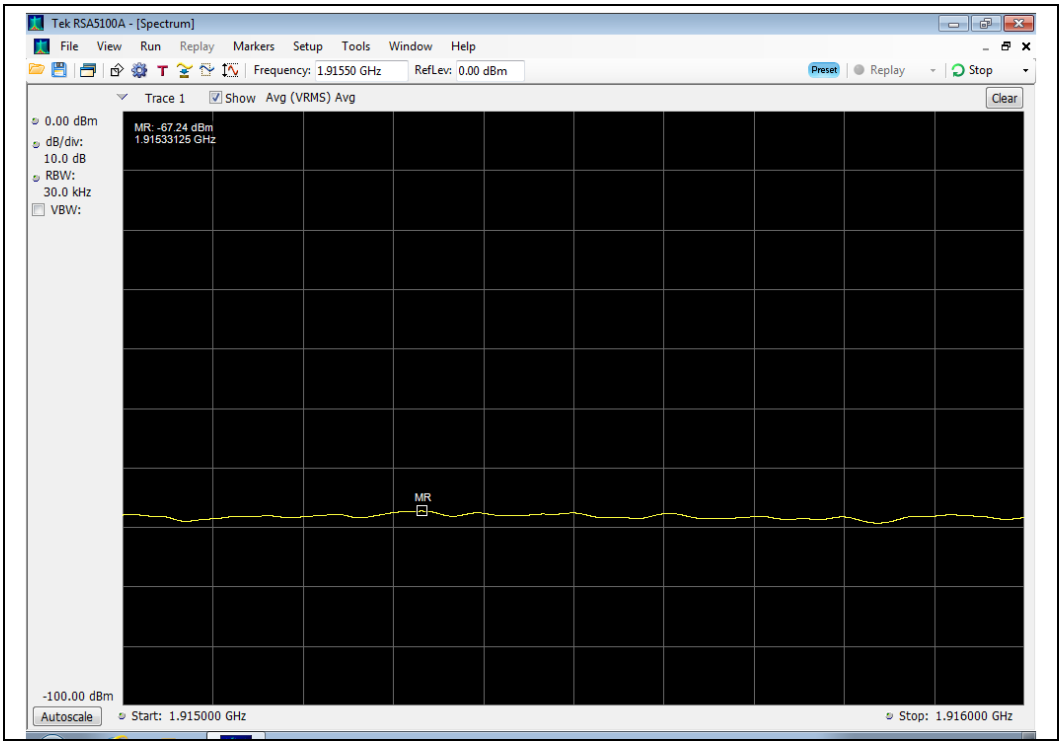


1850 - 1910 MHz Band

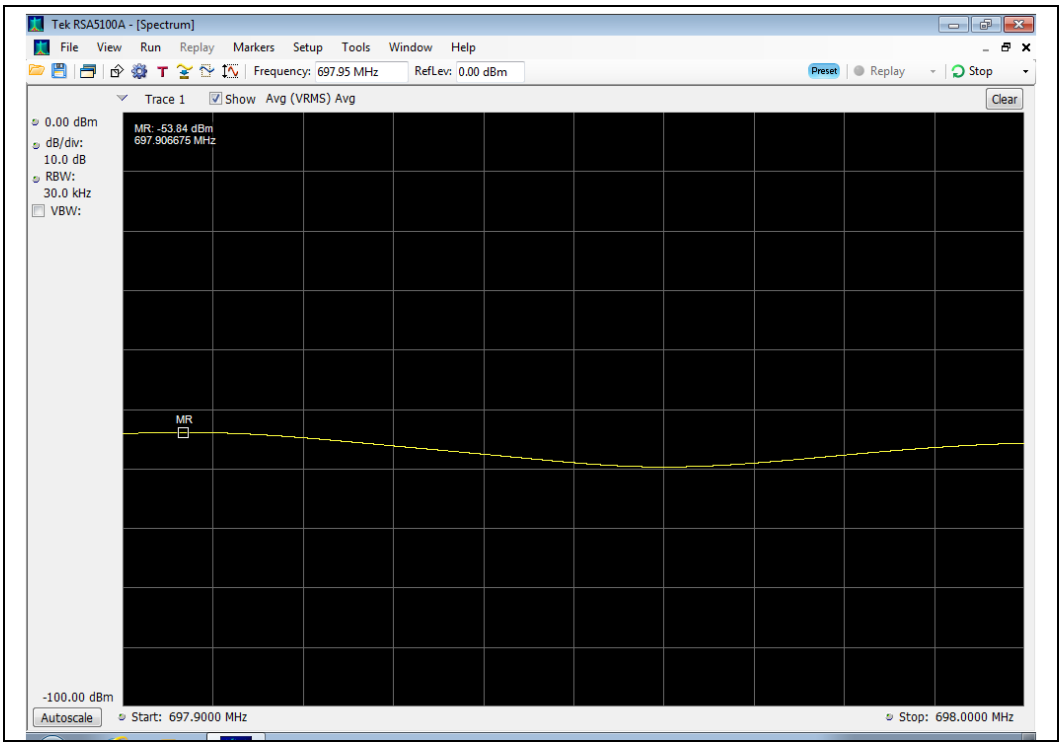
Lower Band Edge



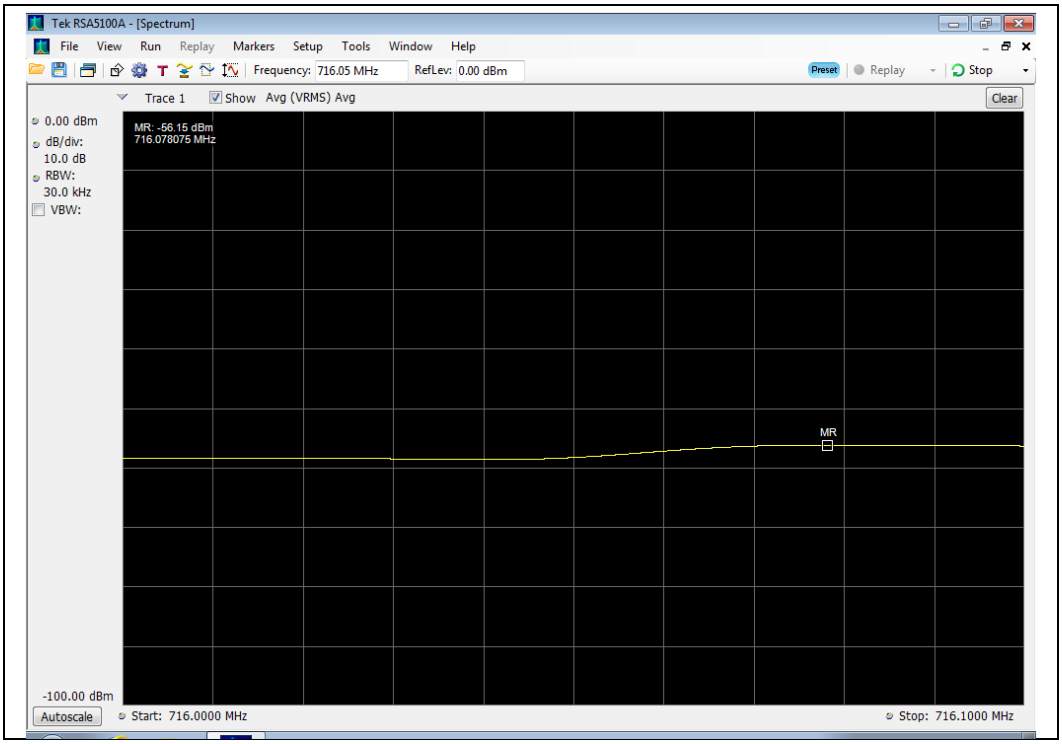
Upper Band Edge



WCDMA Uplink Test Plots
698 - 716 MHz Band
Lower Band Edge

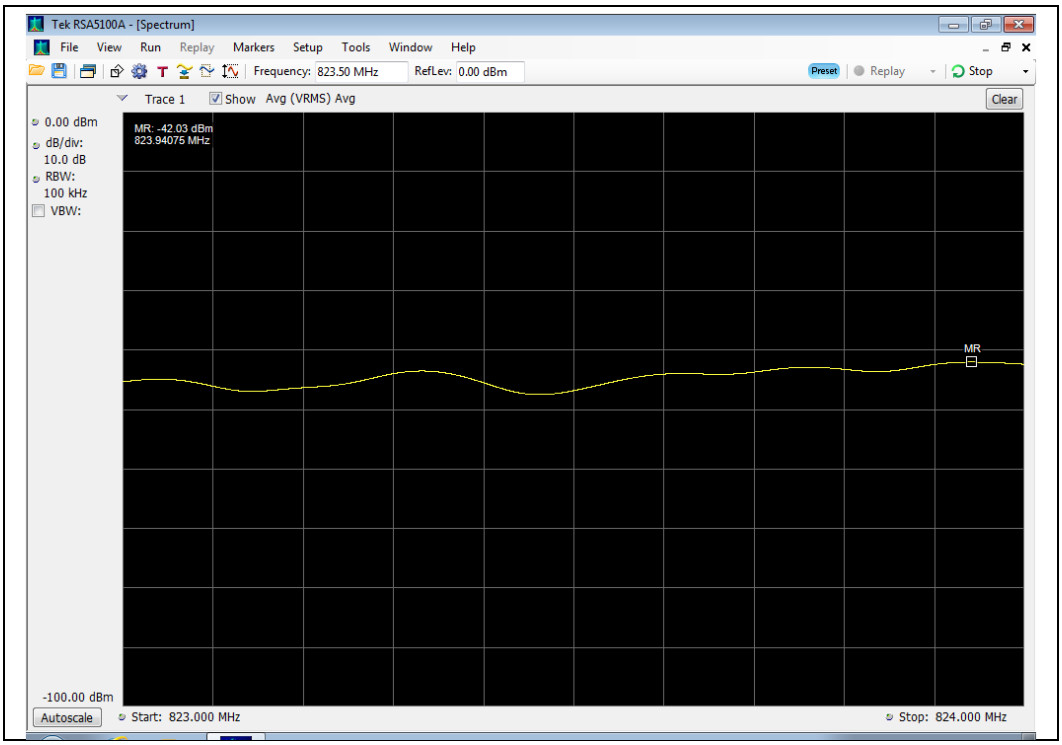


Upper Band Edge

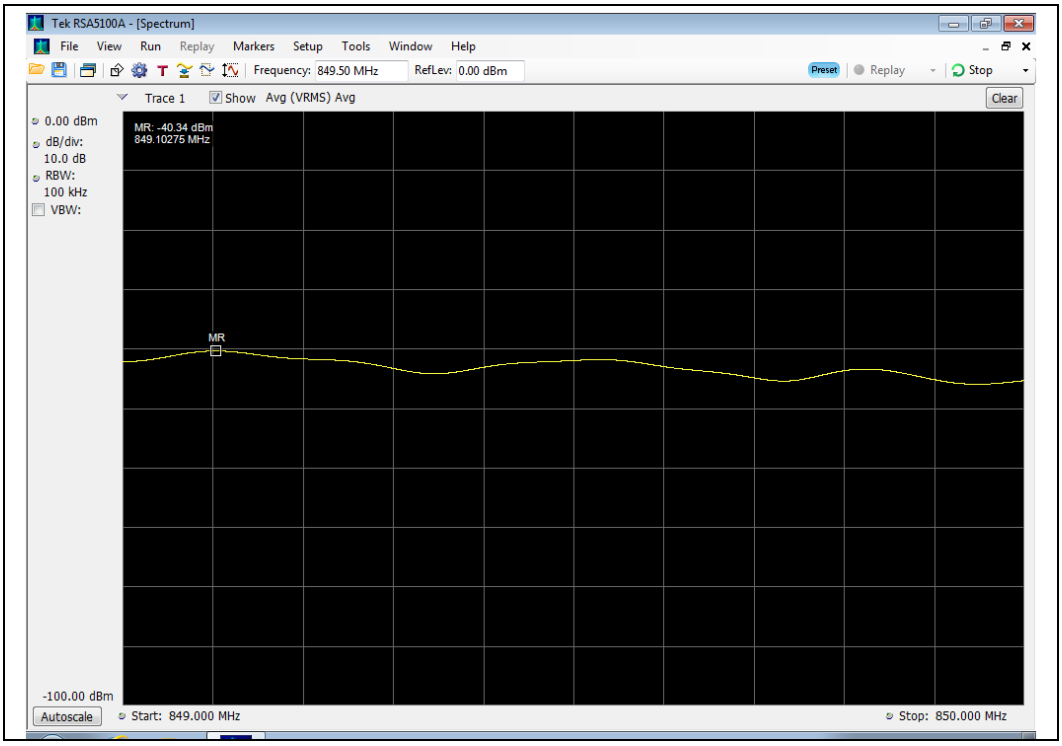


824 - 849 MHz Band

Lower Band Edge

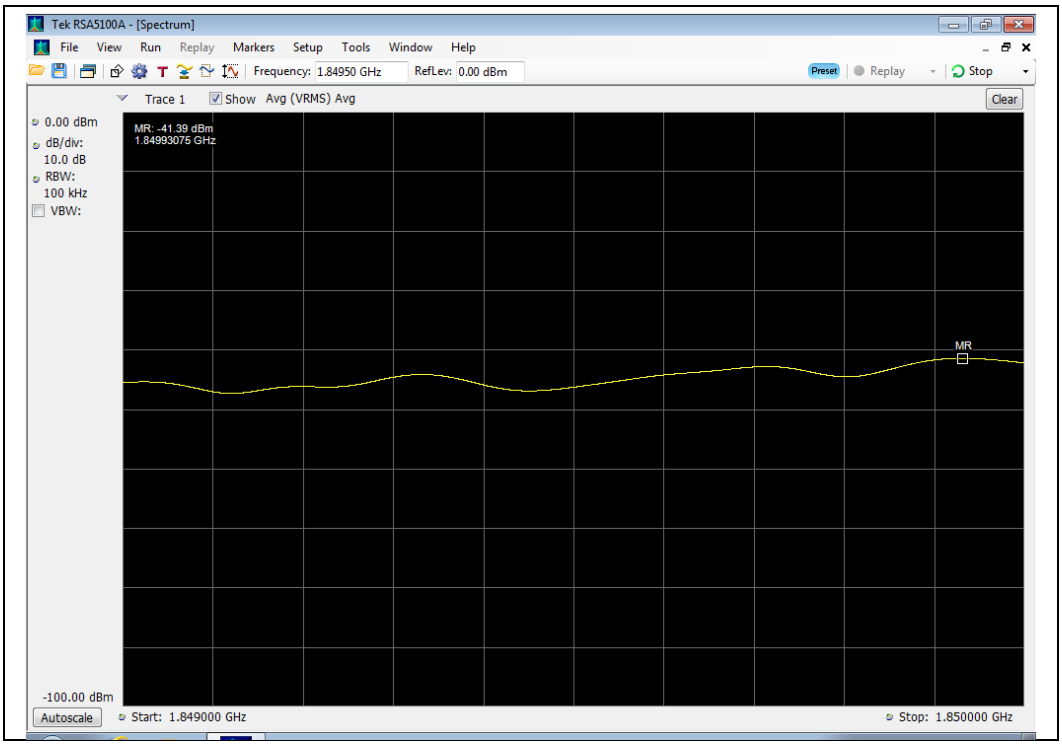


Upper Band Edge

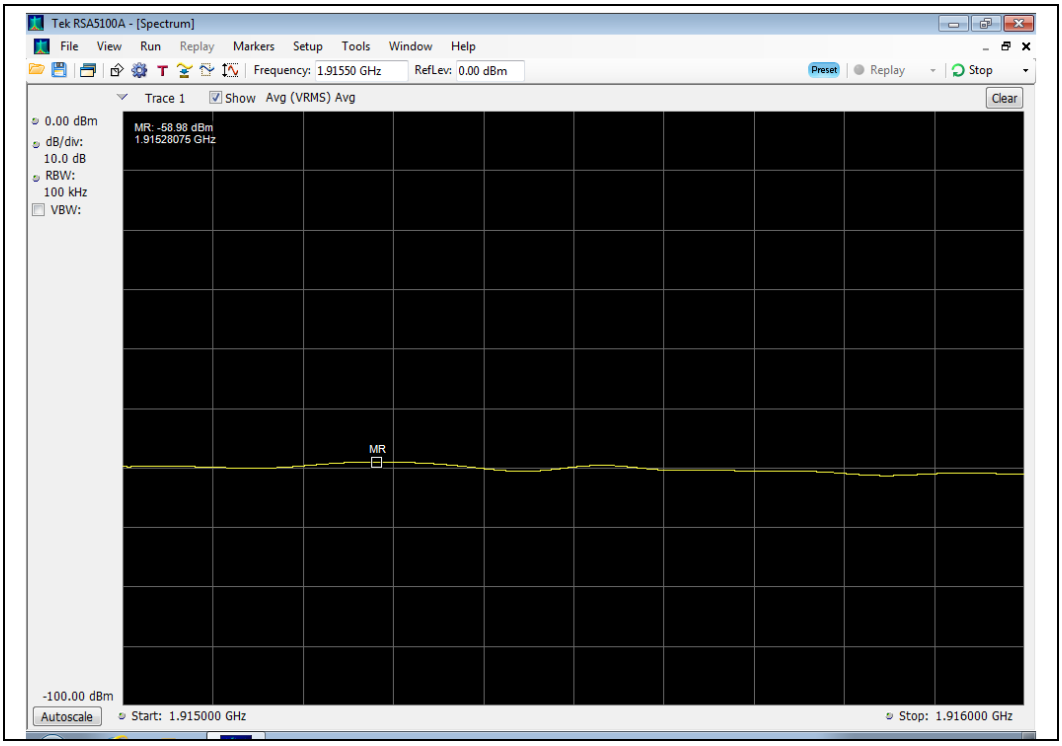


1850 - 1910 MHz Band

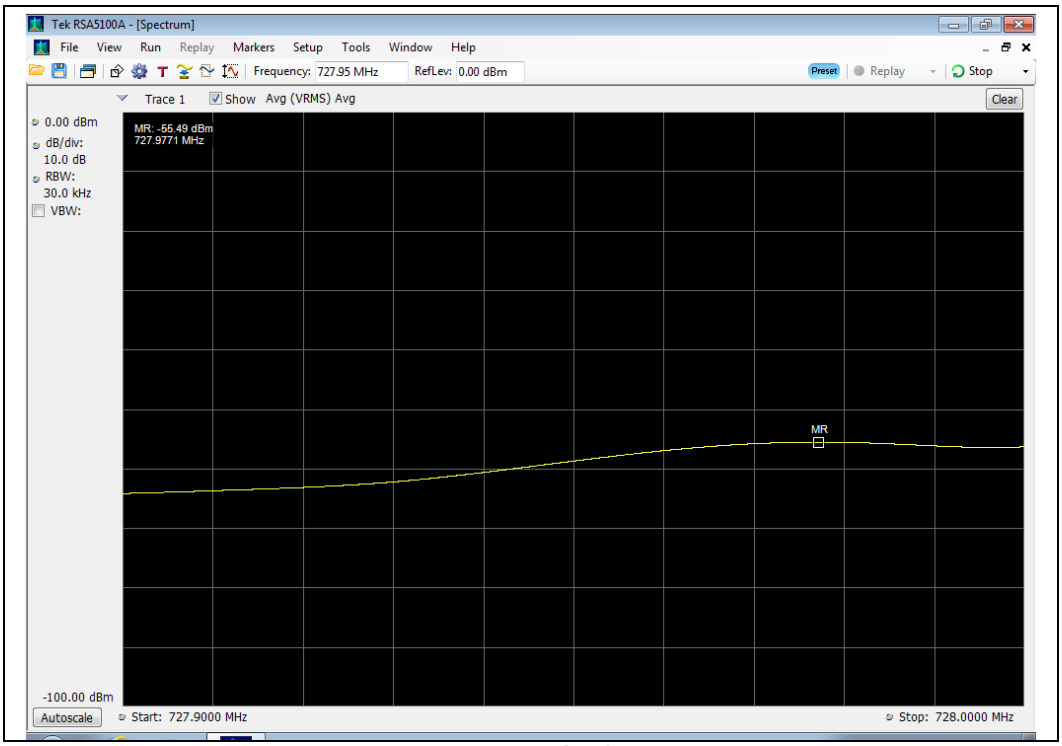
Lower Band Edge



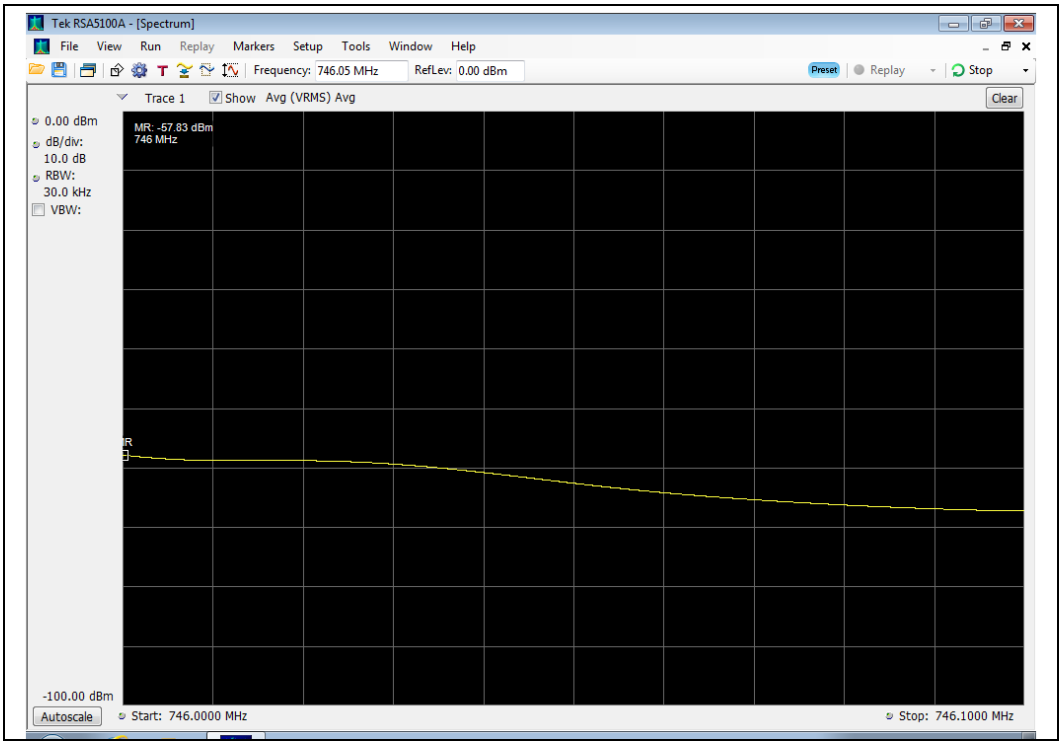
Upper Band Edge



GSM Downlink Test Plots
728 - 746 MHz Band
Lower Band Edge

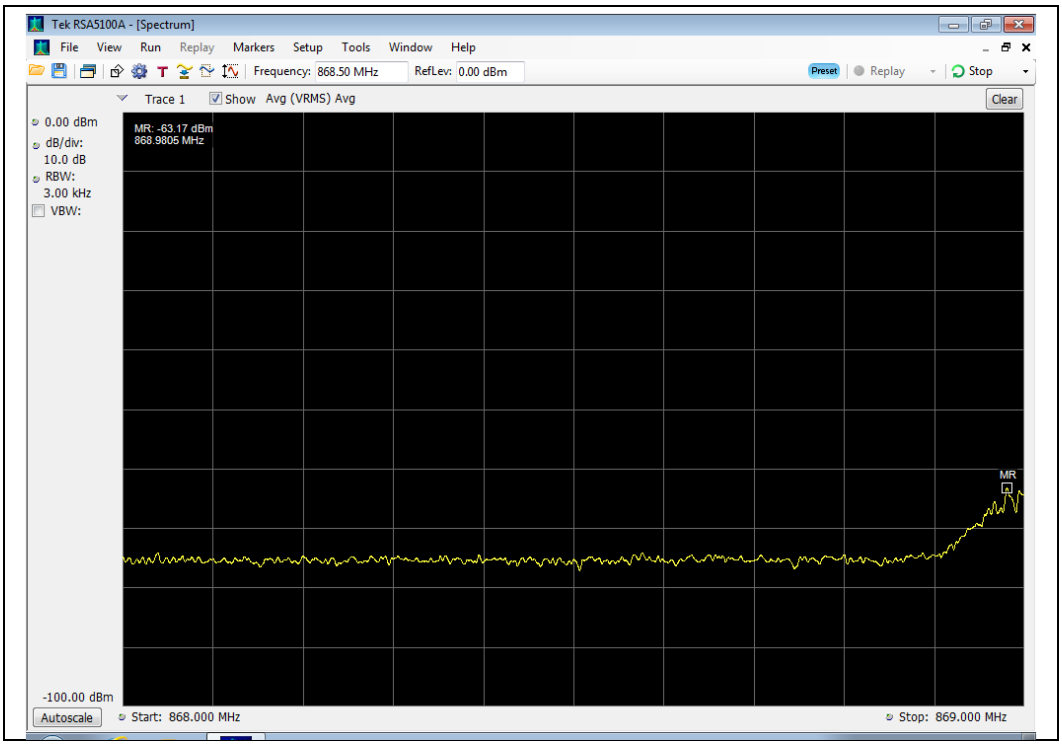


Upper Band Edge

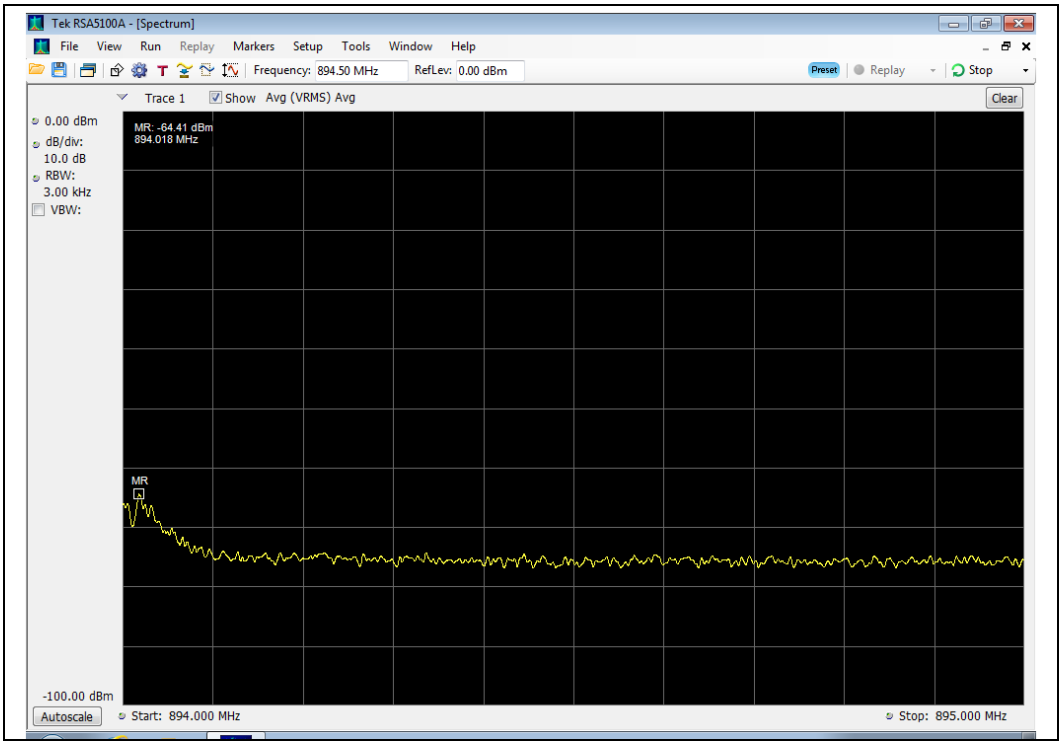


869 - 894 MHz Band

Lower Band Edge

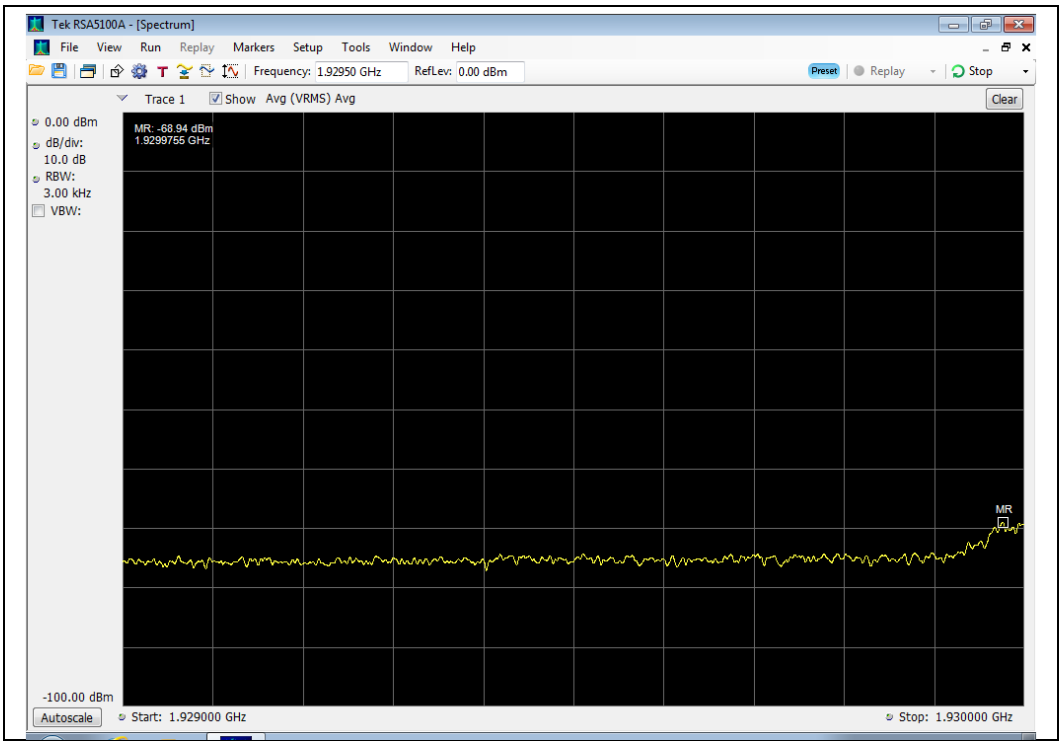


Upper Band Edge

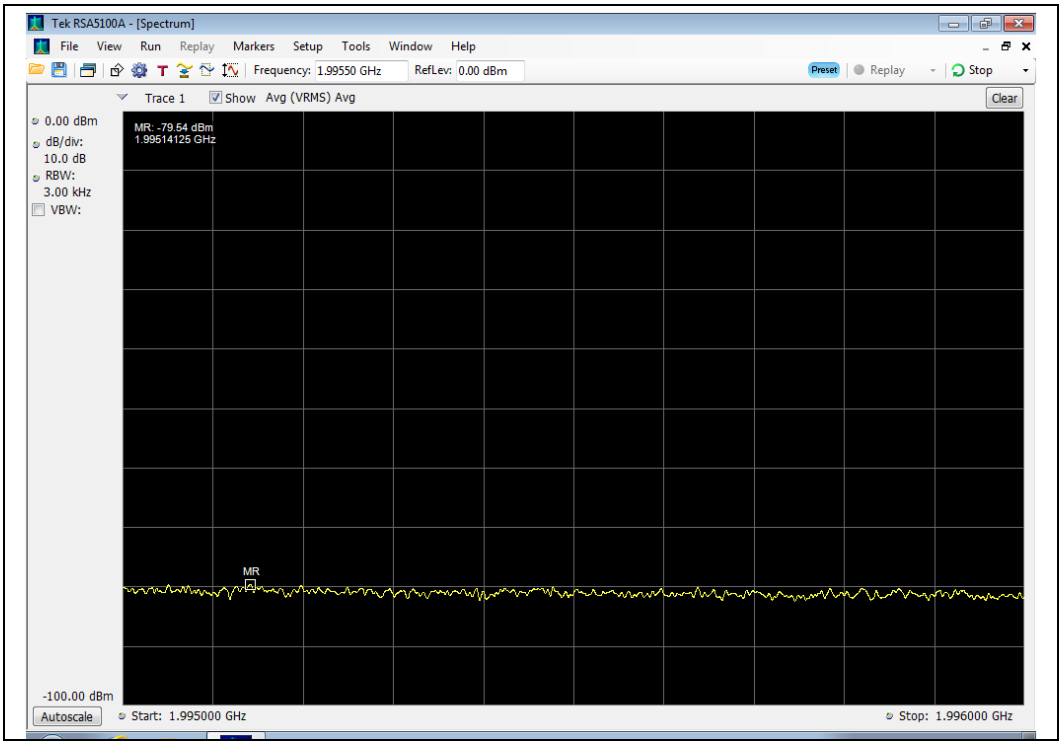


1930 - 1990 MHz Band

Lower Band Edge



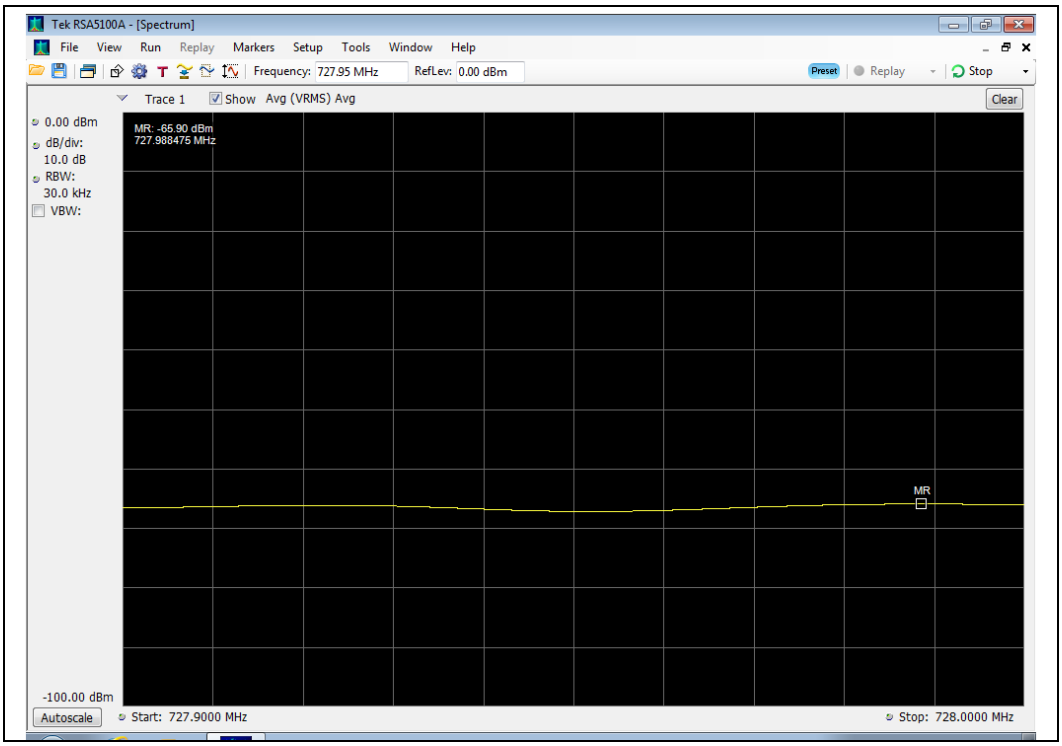
Upper Band Edge



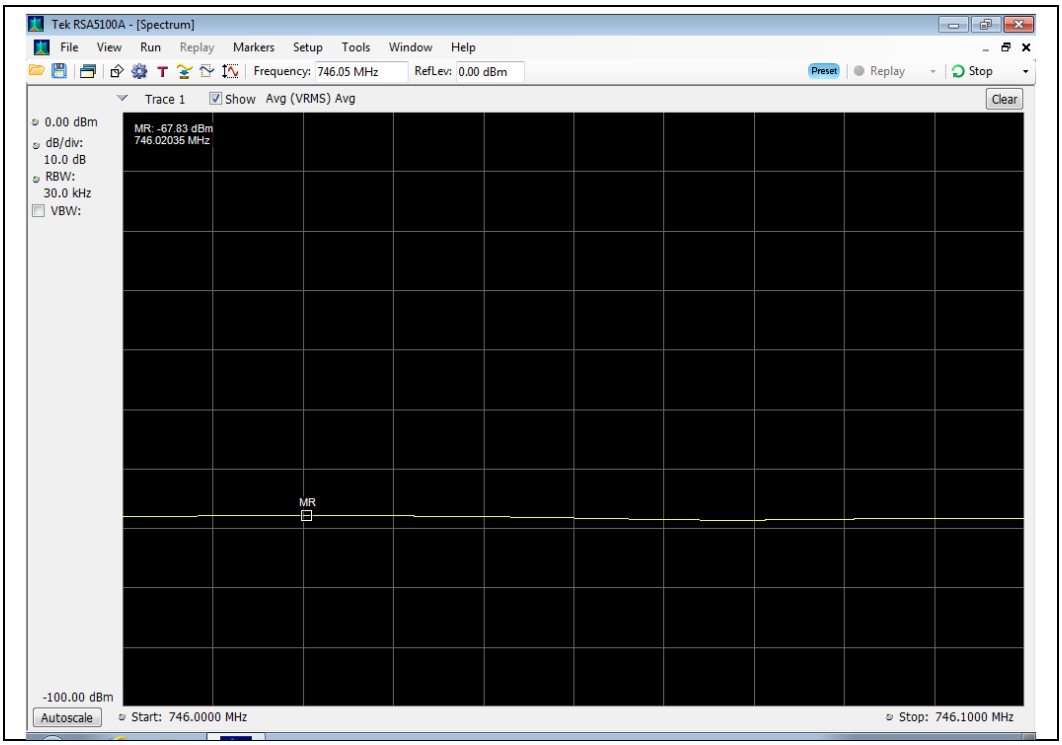
CDMA Downlink Test Plots

728 - 746 MHz Band

Lower Band Edge

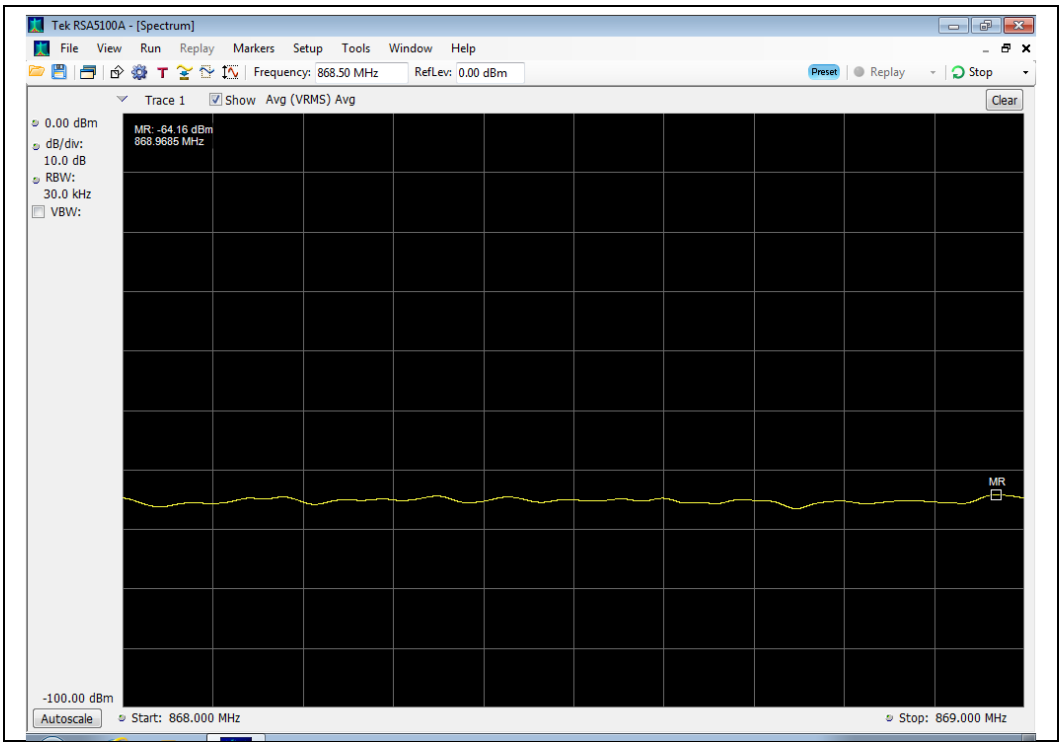


Upper Band Edge

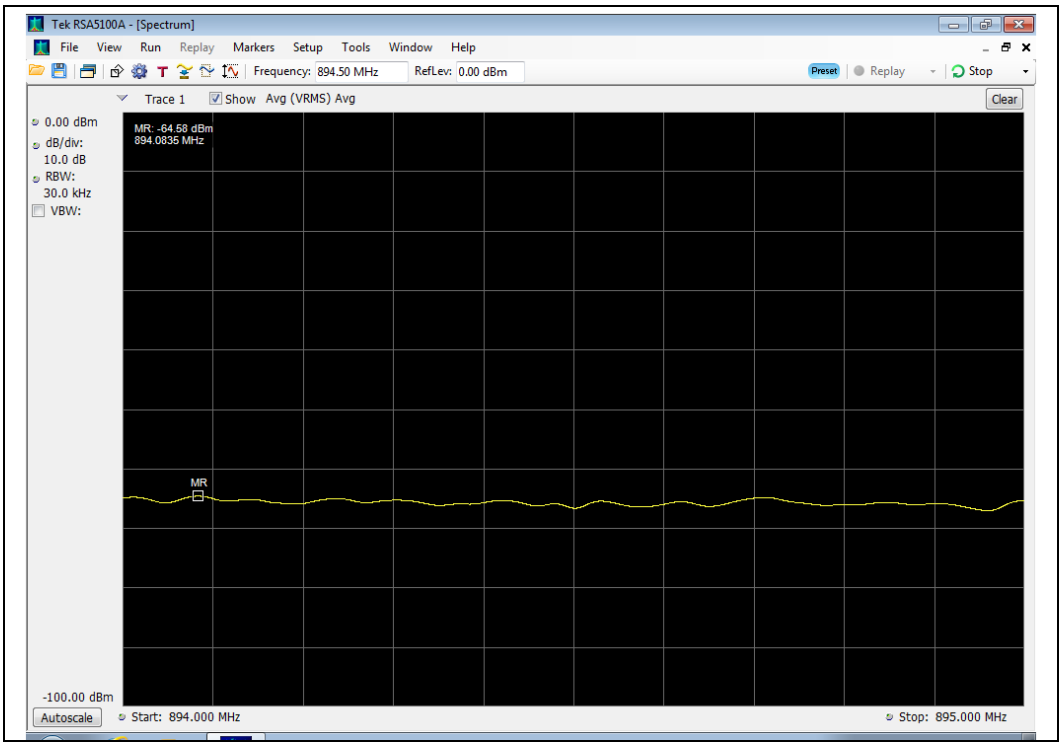


869 - 894 MHz Band

Lower Band Edge

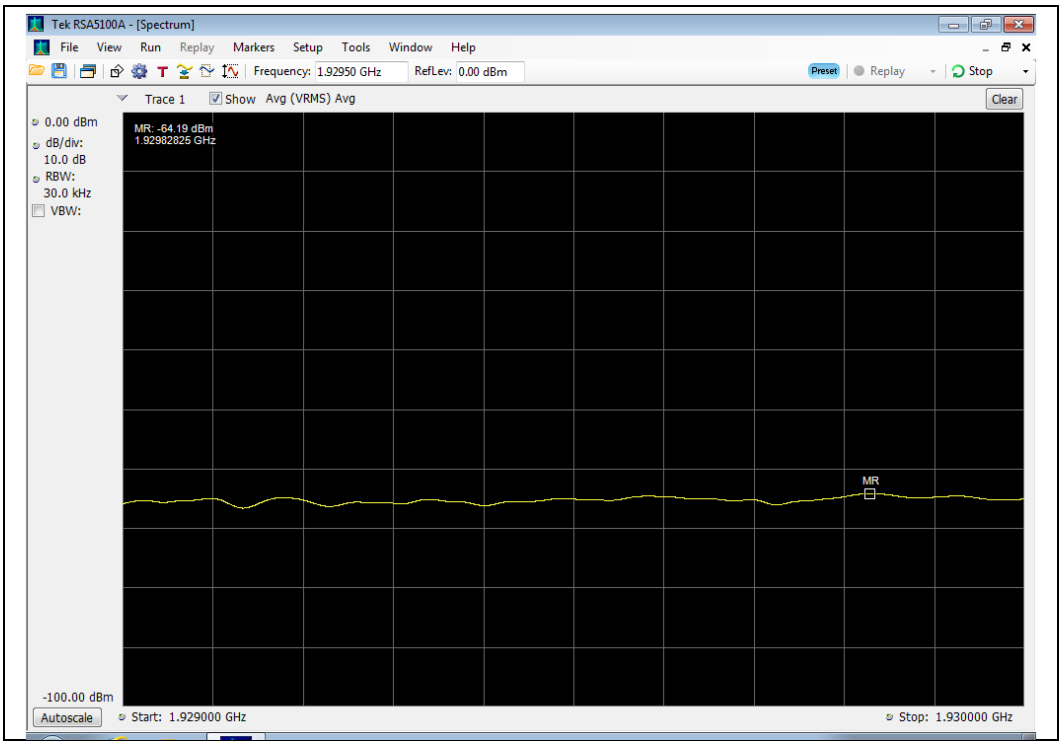


Upper Band Edge

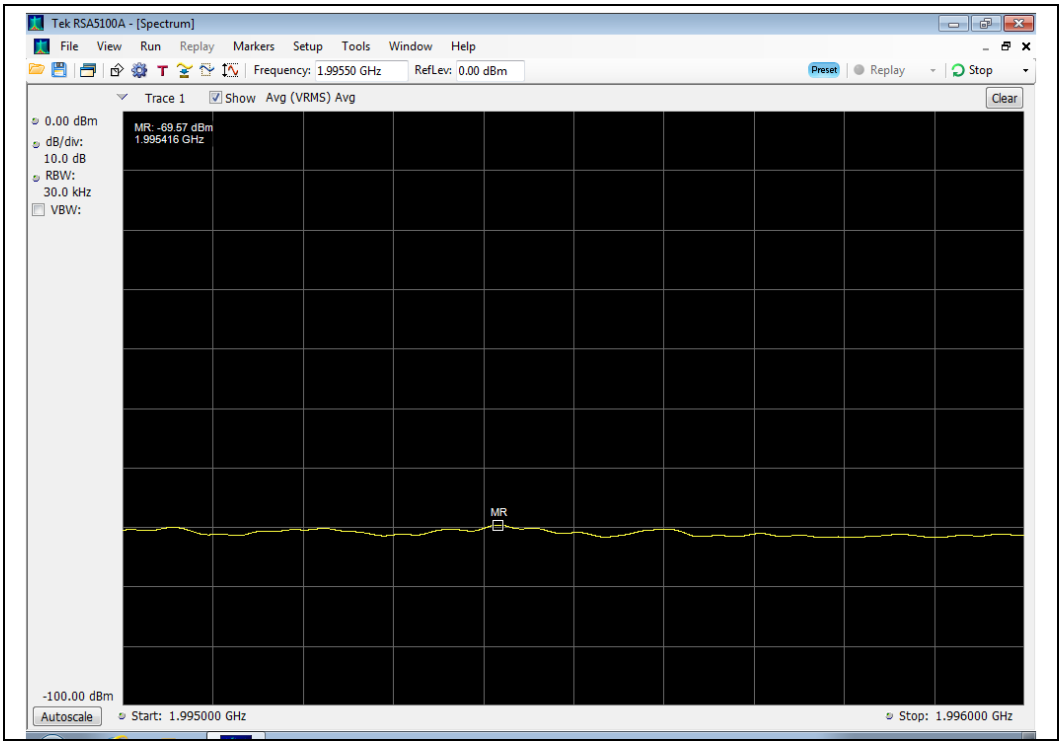


1930 - 1990 MHz Band

Lower Band Edge



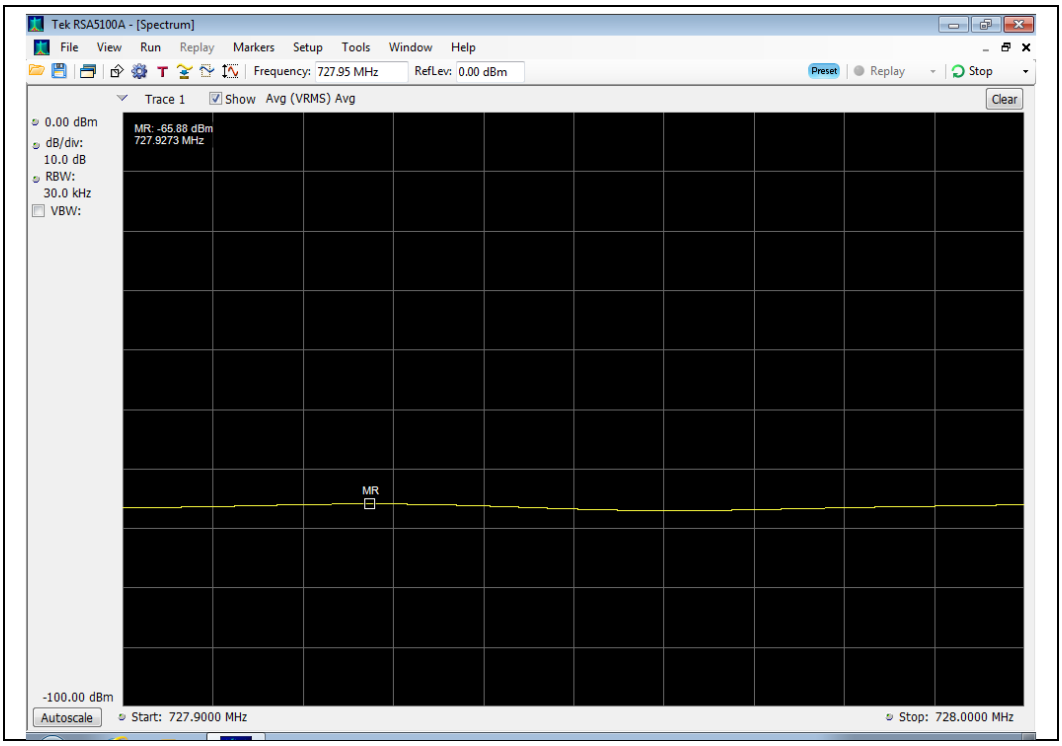
Upper Band Edge



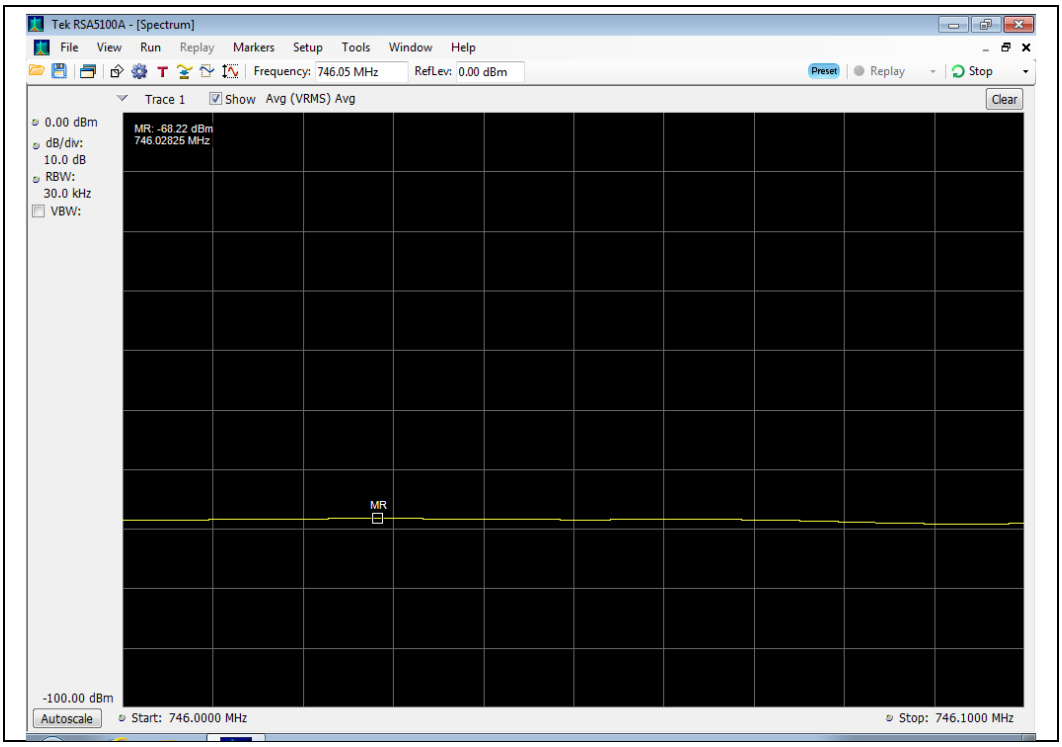
WCDMA Downlink Test Plots

728 - 746 MHz Band

Lower Band Edge

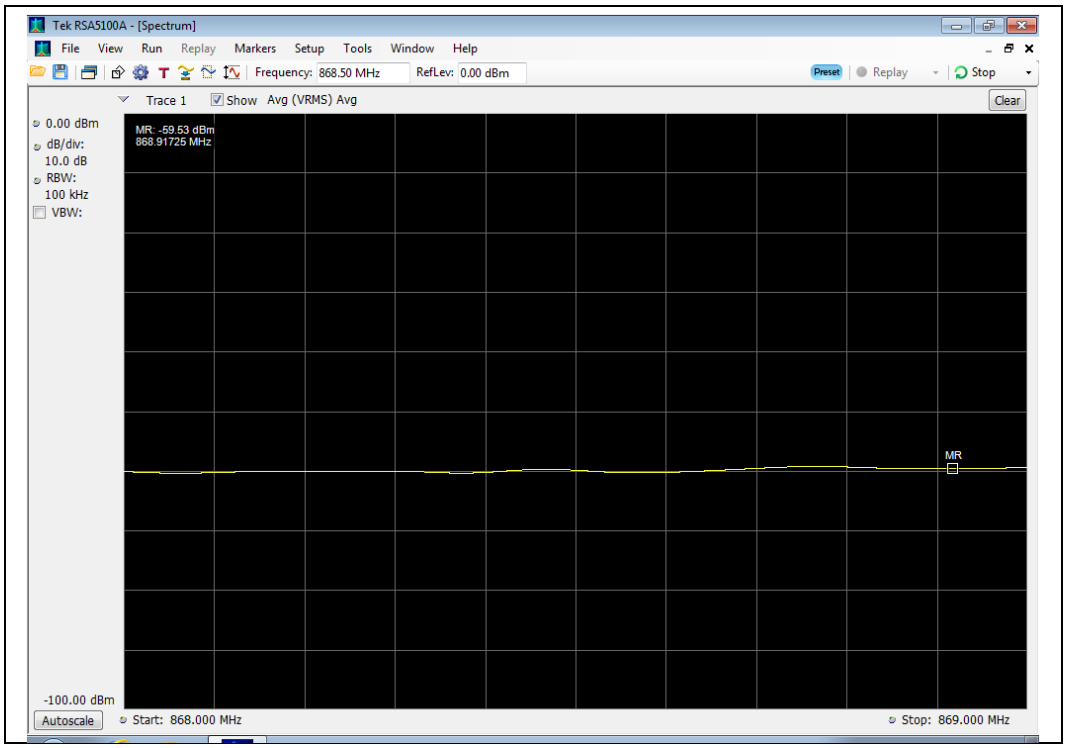


Upper Band Edge

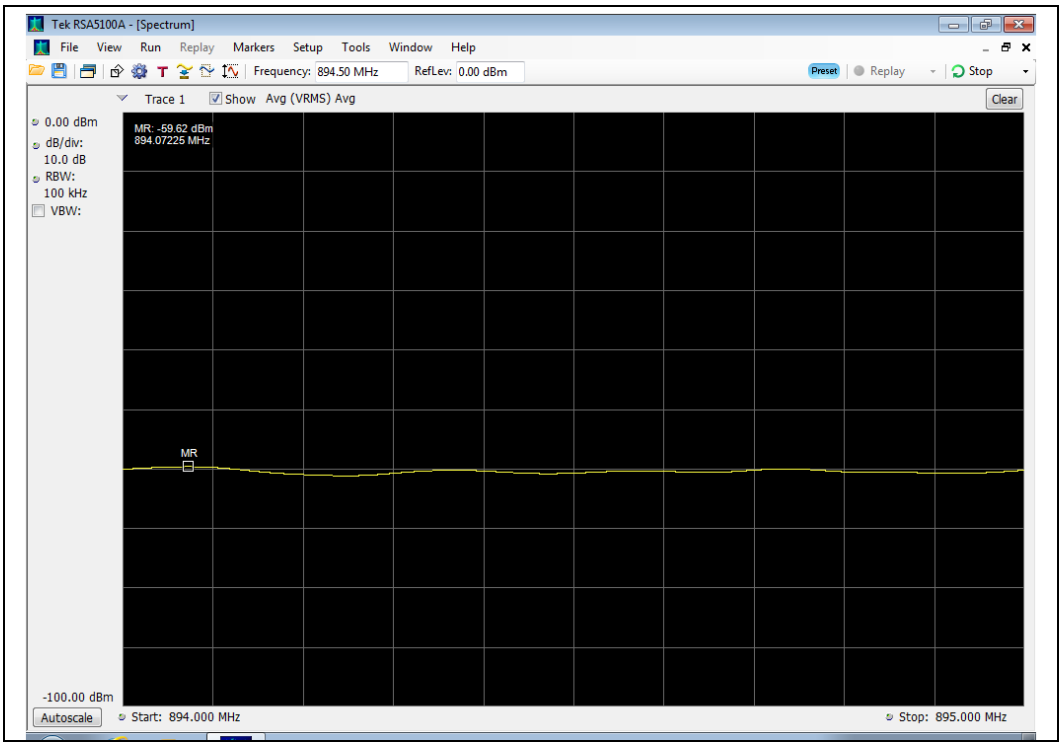


869 - 894 MHz Band

Lower Band Edge

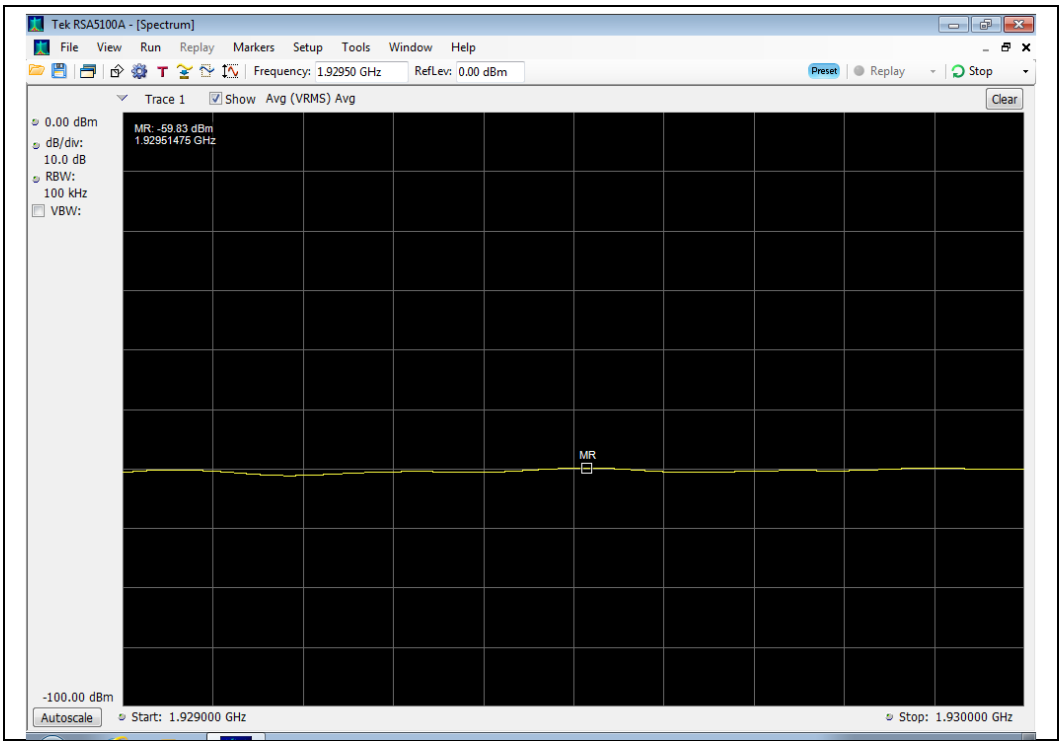


Upper Band Edge

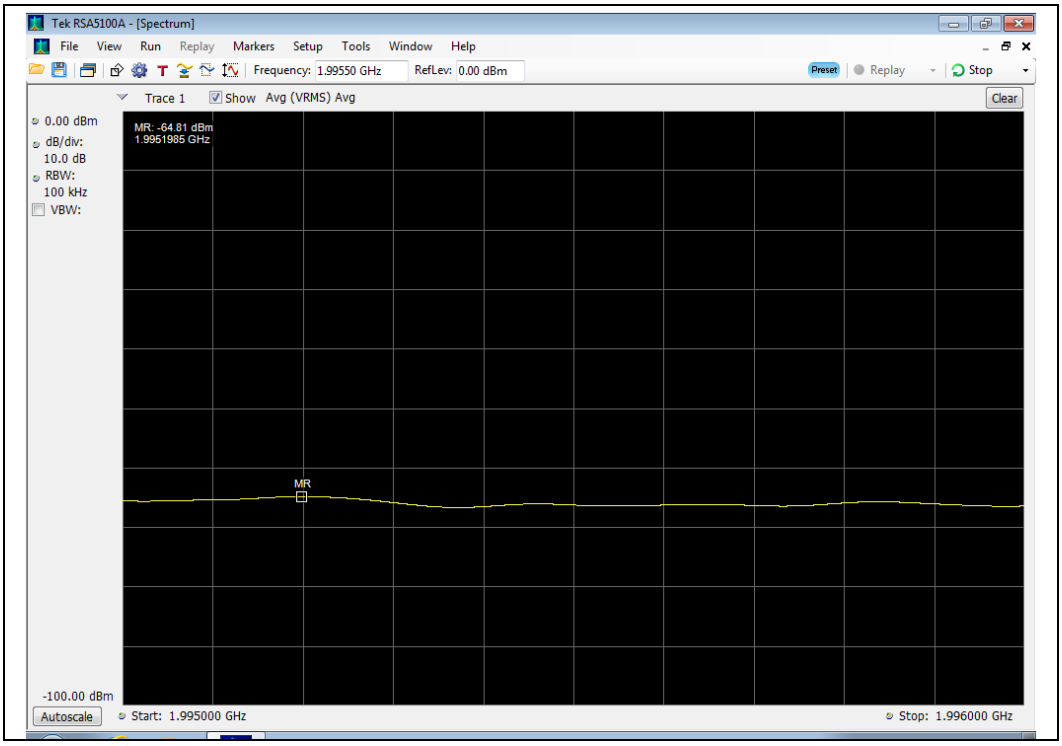


1930 - 1990 MHz Band

Lower Band Edge



Upper Band Edge



Conducted Spurious Emissions

Name of Test: Conducted Spurious Emissions **Engineer:** Greg Corbin
Test Equipment Utilized: i00424, SMU 200A - S/N:101369 **Test Date:** 11/27/2013

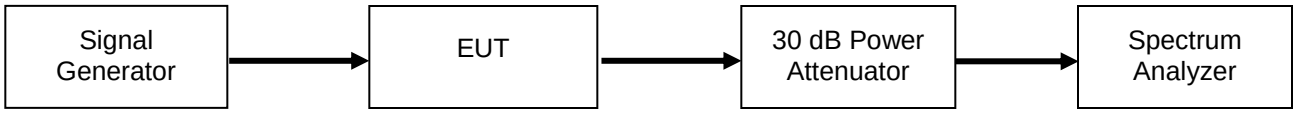
Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator, with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings. A signal generator was utilized to produce a 4.1 MHz AWGN signal operating at the maximum allowable power. The conducted spurious emissions from 9 kHz to 10 times the highest tunable frequency for each operational band were measured (excluding the band defined by the Out of band emissions test). The emissions were plotted and the highest level was recorded in the summary table.

The following formulas are used for calculating the limits.

Conducted Spurious Emissions Limit = P1 – (43+ 10Log(P2)) = -13 dBm
where P1 = power in dBm and P2 = power in Watts

Test Setup



Uplink Test Results

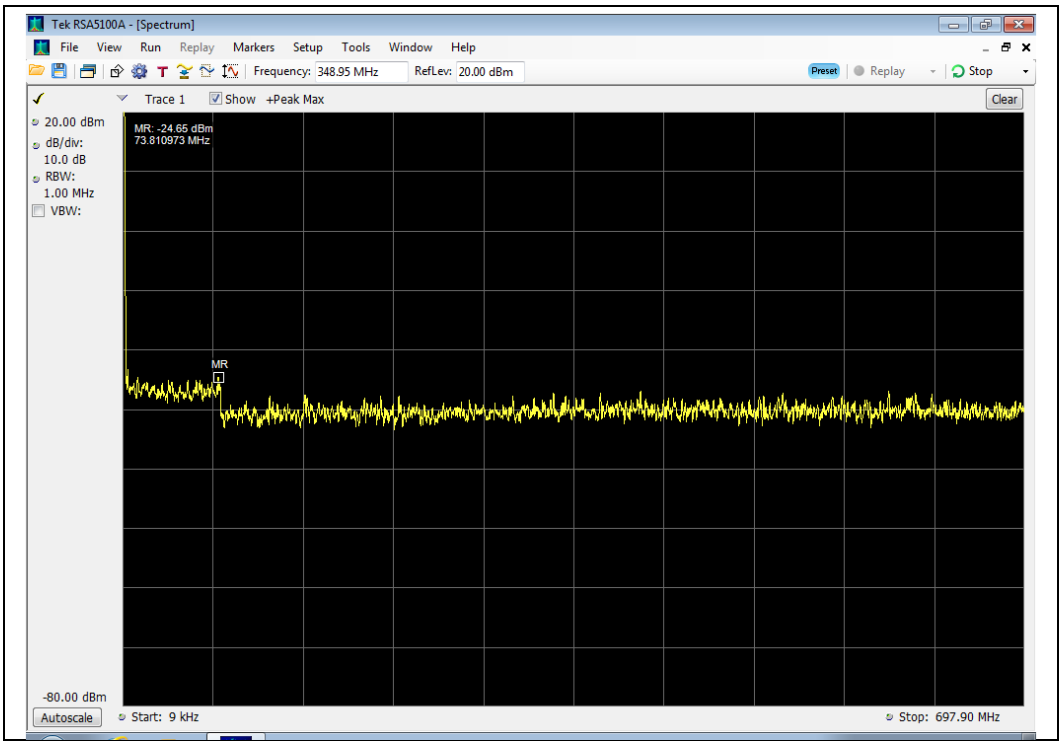
Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	73.81	-24.6	-13	Pass
824 - 849	7470	-23.8	-13	Pass
1850 - 1910	19869	-20.1	-13	Pass

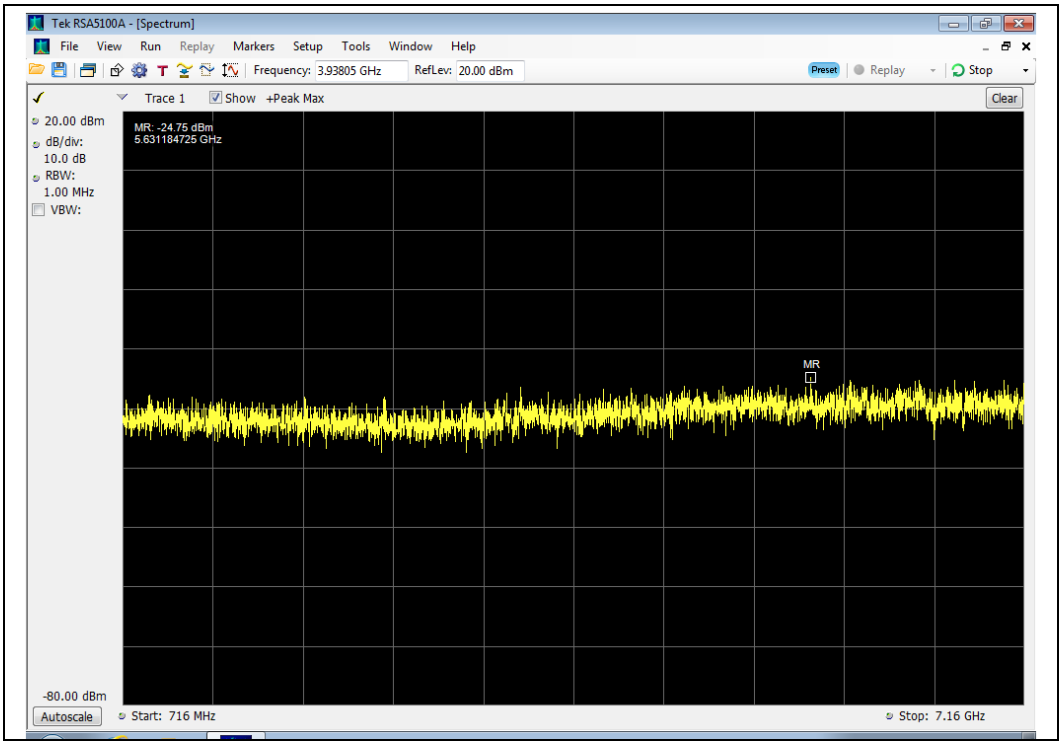
Downlink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	6605.6	-24	-13	Pass
869 - 894	7377.2	-23.4	-13	Pass
1930 - 1990	19376.2	-20.4	-13	Pass

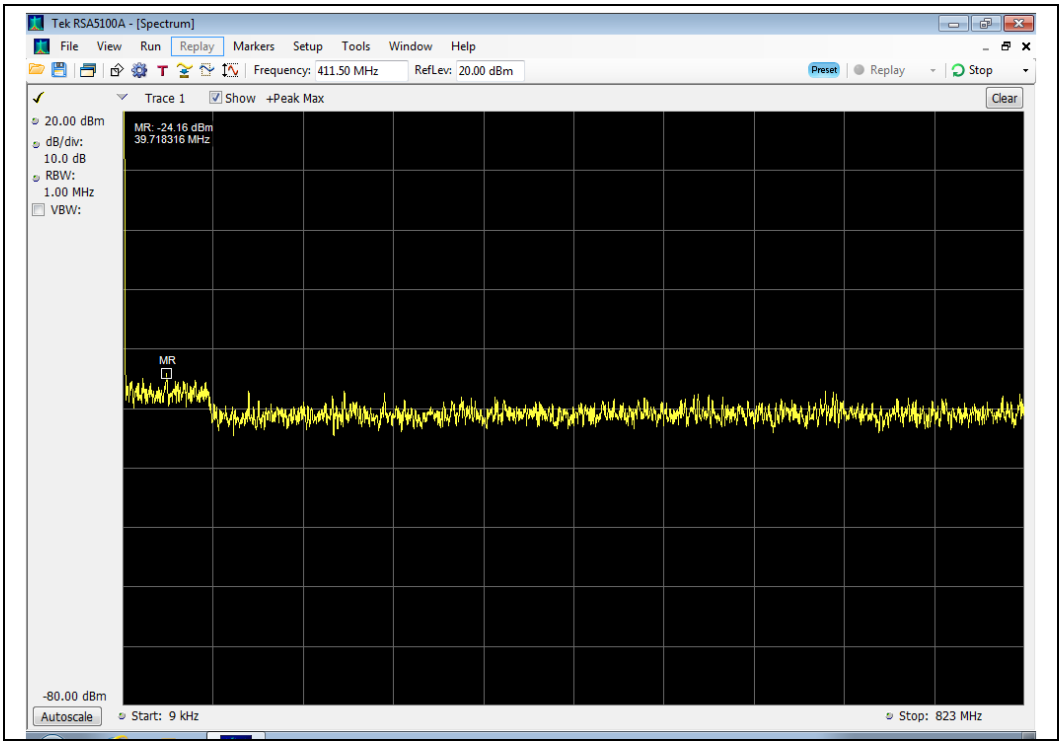
Uplink Test Plots

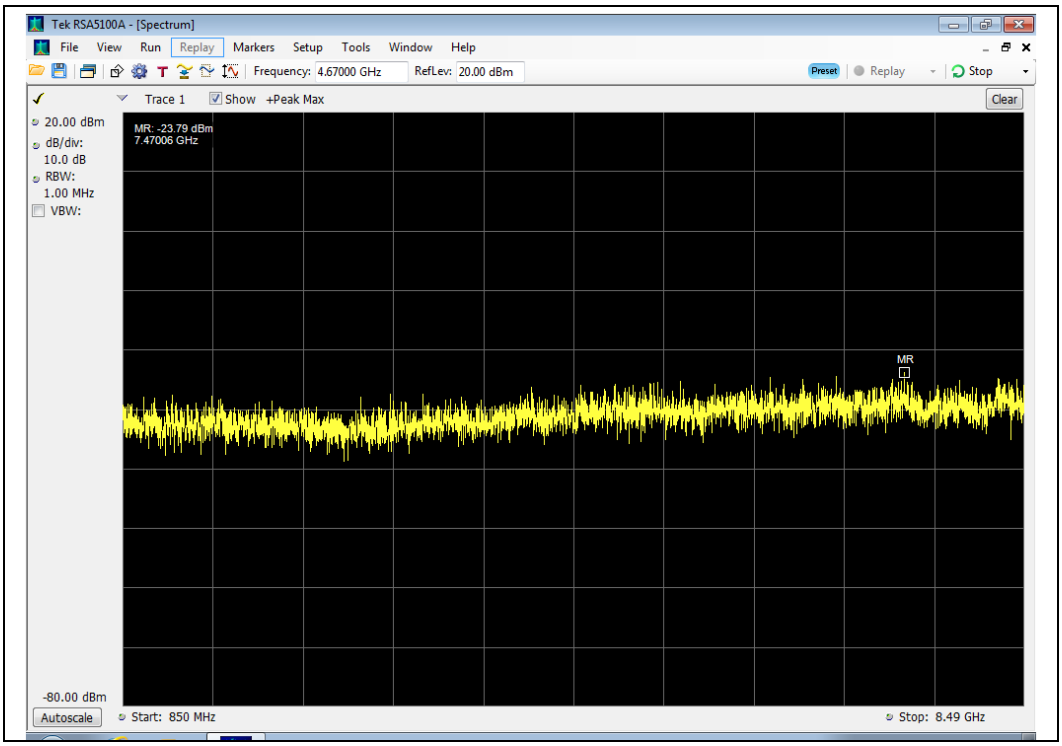
698 - 716 MHz Band



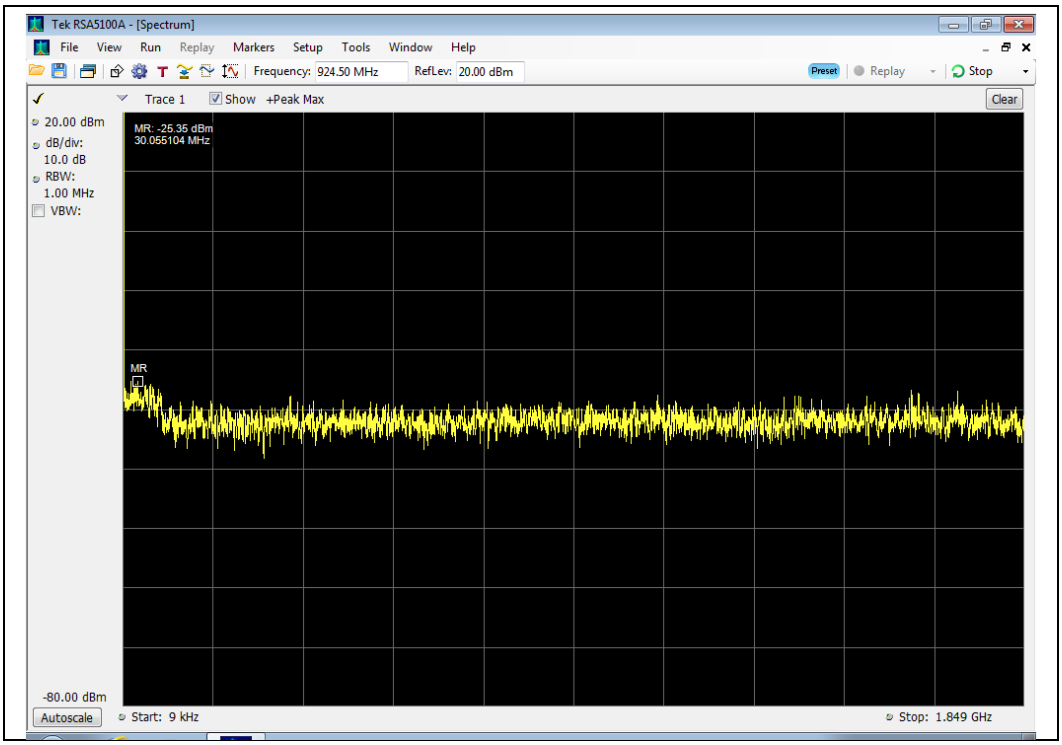


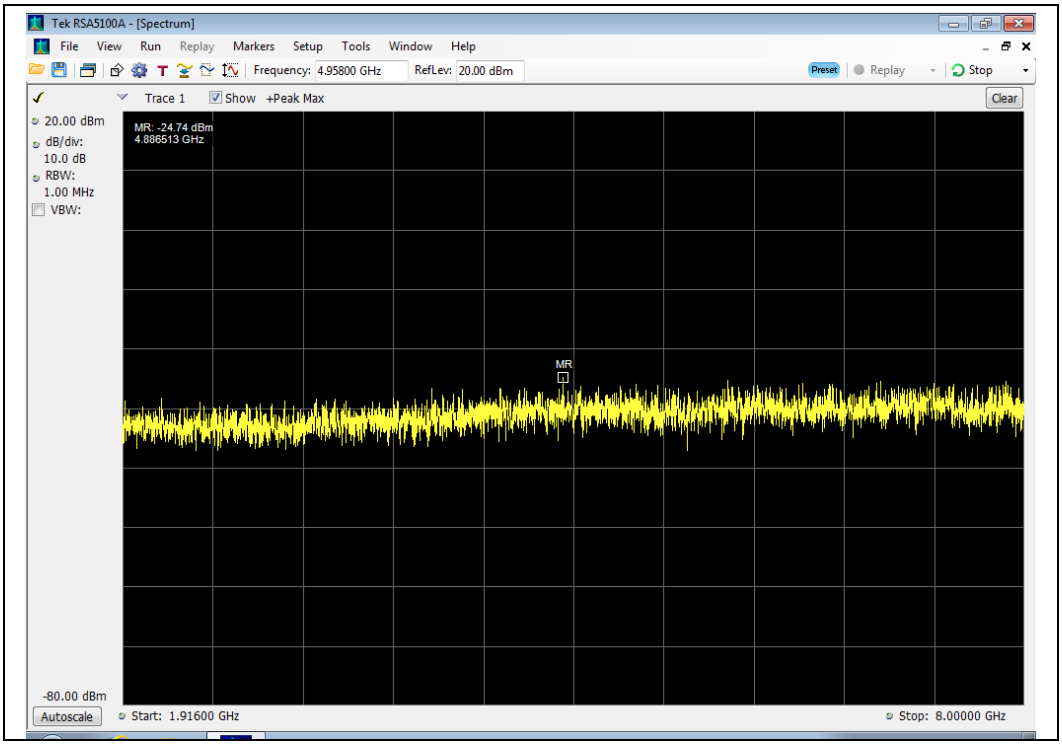
824 - 849 MHz Band

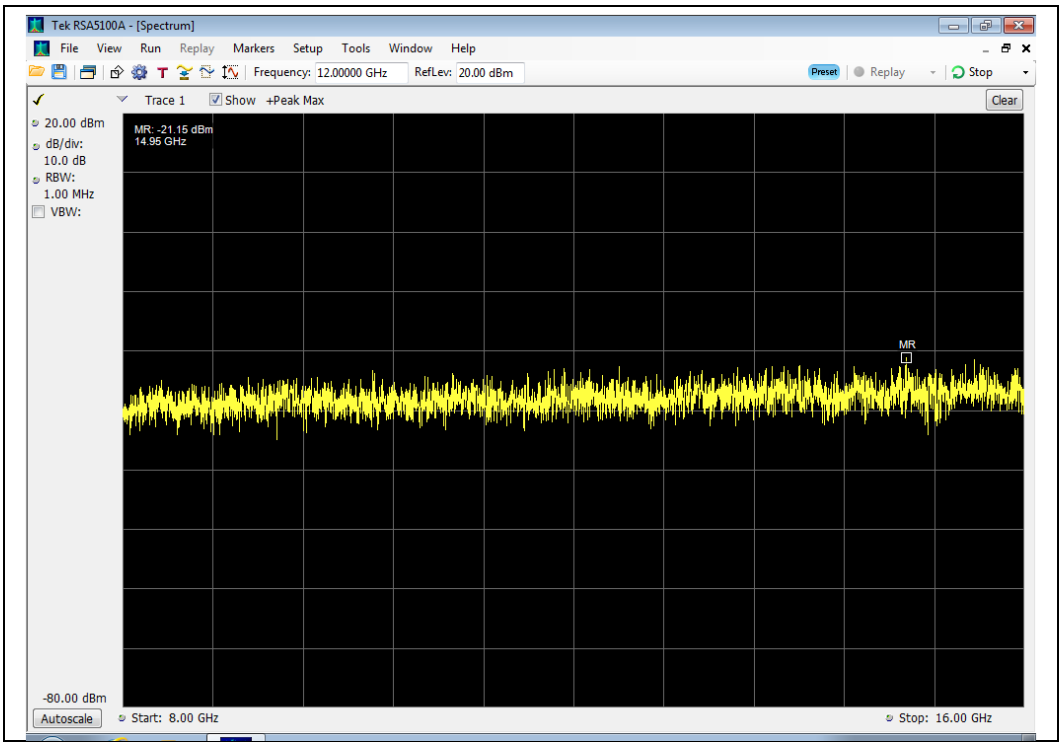


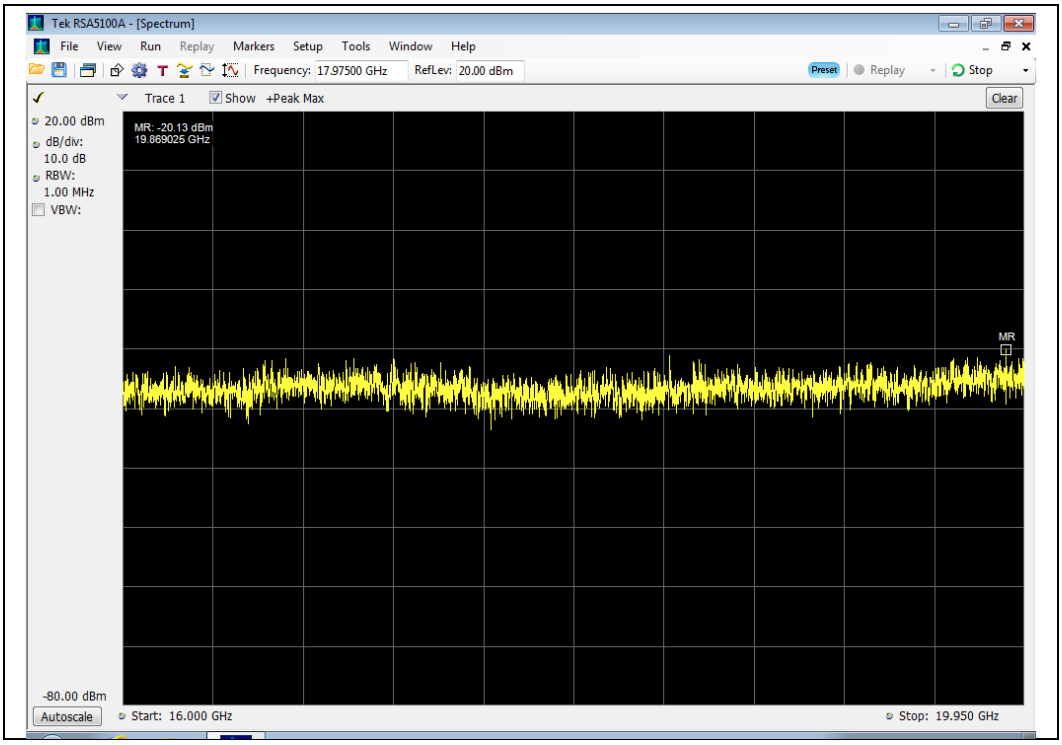


1850 - 1910 MHz Band



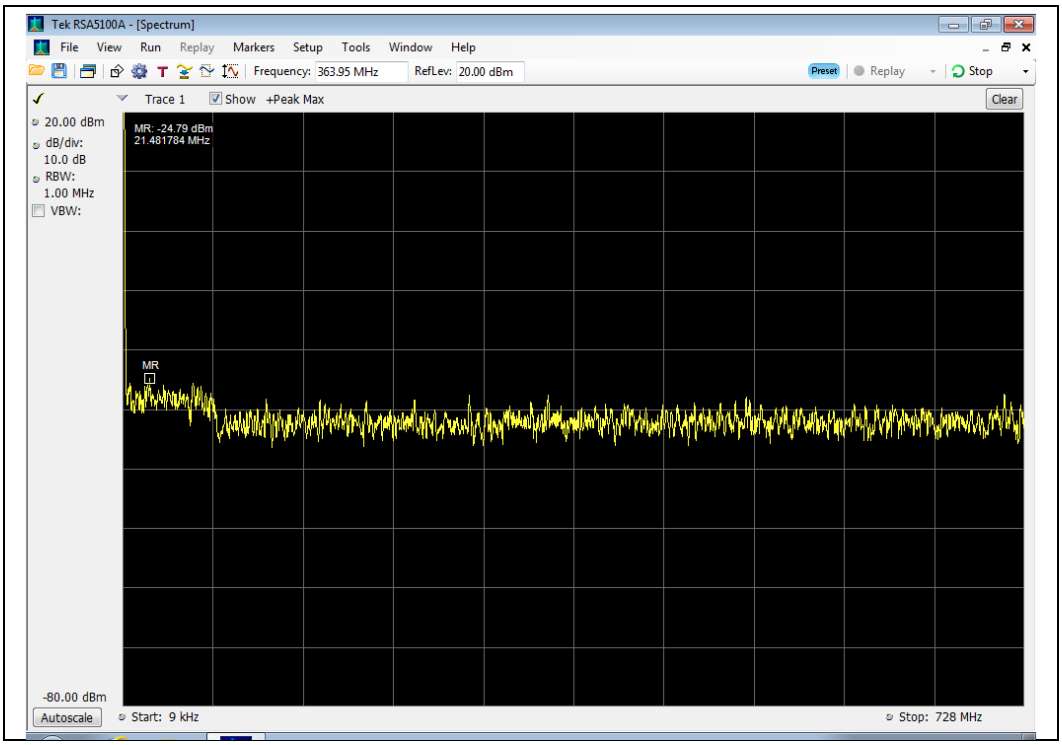


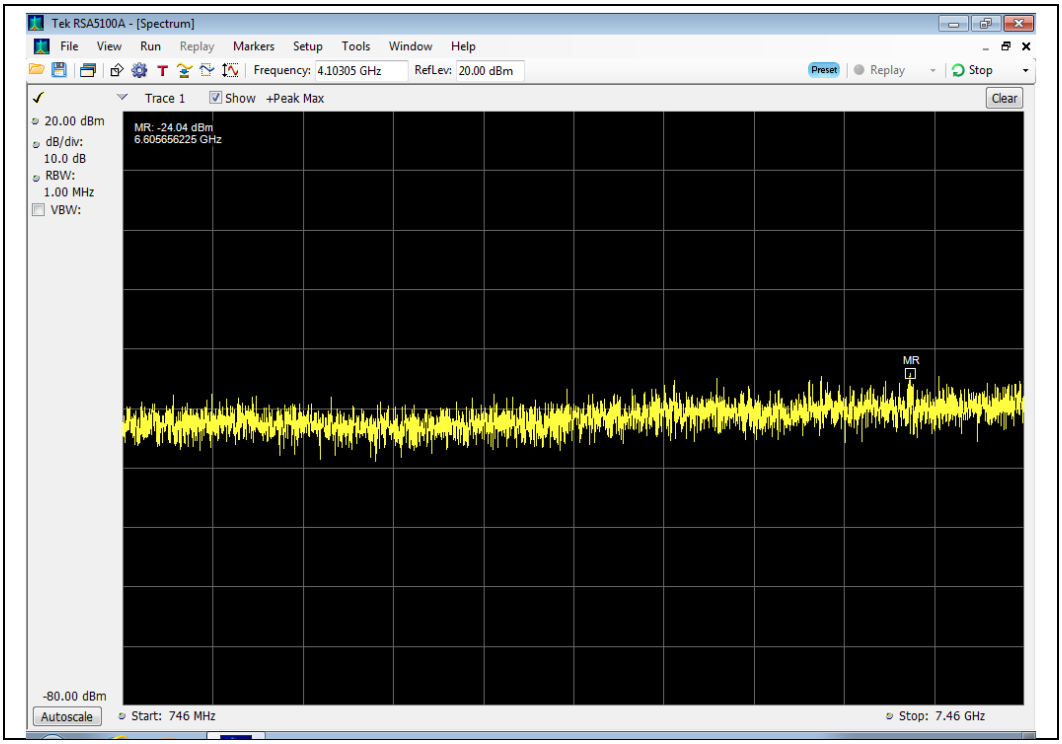

Tek RSA5100A - [Spectrum]
File View Run Replay Markers Setup Tools Window Help
Frequency: 12.00000 GHz
RefLev: 20.00 dBm
Preset
Replay
Stop
Trace 1
Show
+Peak Max
Clear
20.00 dBm
dB/div:
10.0 dB
RBW:
1.00 MHz
VBW:
MR: -21.15 dBm
14.95 GHz
MR
-80.00 dBm
Autoscale
Start: 8.00 GHz
Stop: 16.00 GHz


Tek RSA5100A - [Spectrum]
File View Run Replay Markers Setup Tools Window Help
Frequency: 17.97500 GHz
RefLev: 20.00 dBm
Preset
Replay
Stop
Trace 1
Show
+Peak Max
Clear
20.00 dBm
dB/div:
10.0 dB
RBW:
1.00 MHz
VBW:
MR: -20.13 dBm
19.869025 GHz
MR
-80.00 dBm
Autoscale
Start: 16.000 GHz
Stop: 19.950 GHz

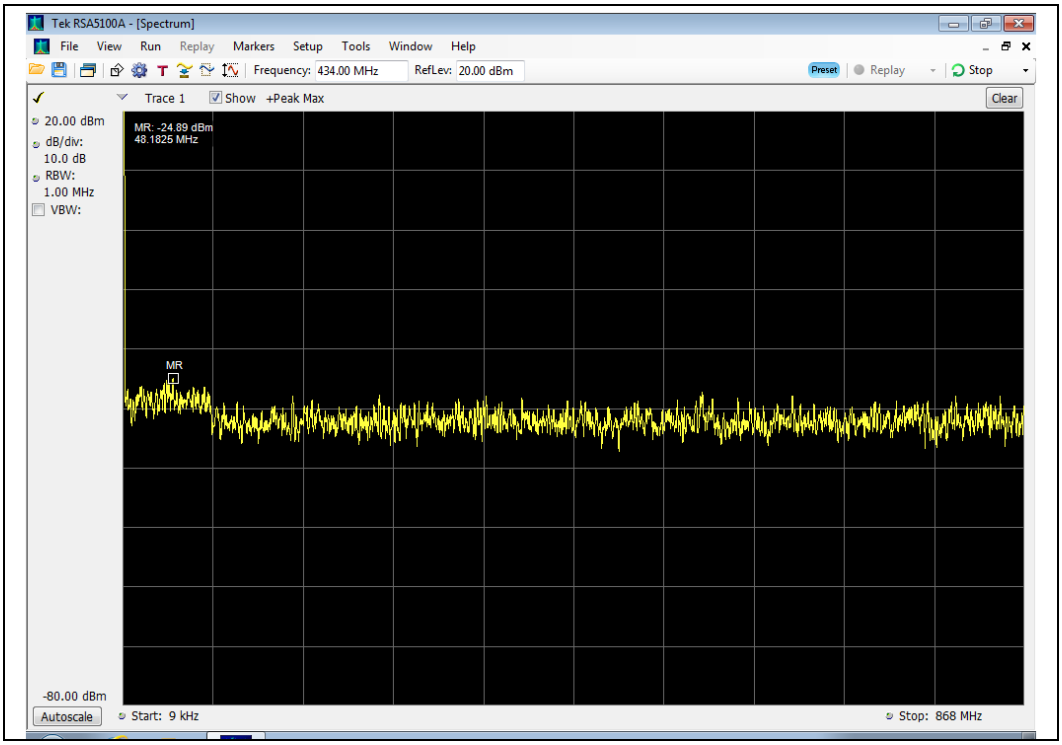
Downlink Test Plots

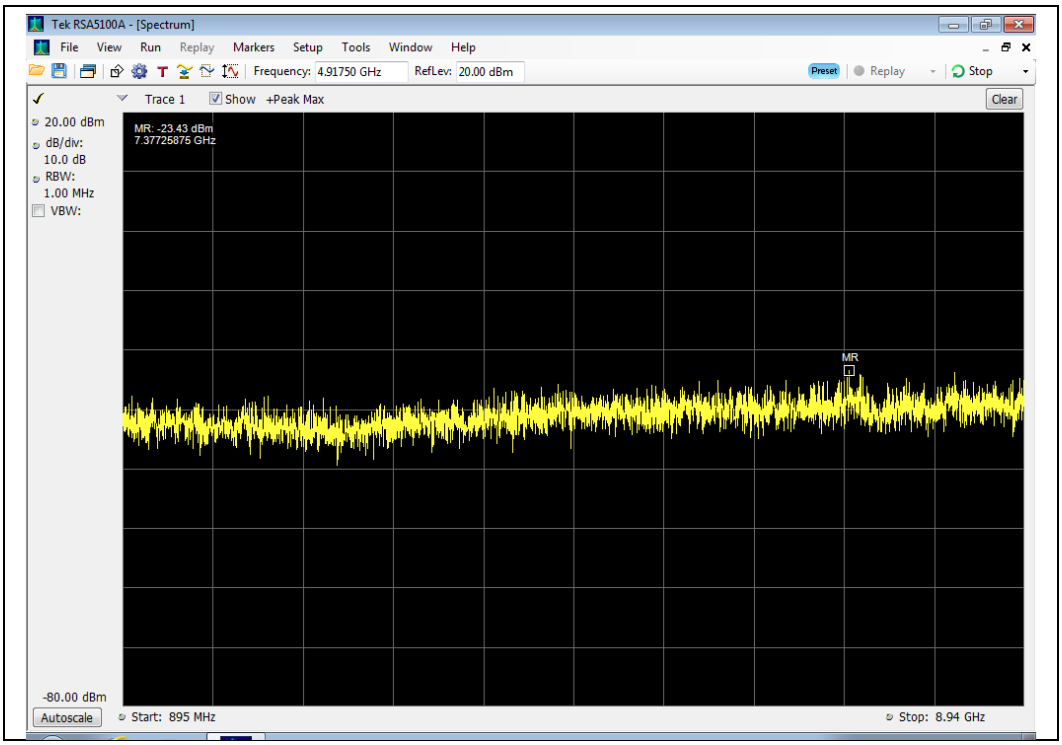
728 - 746 MHz Band



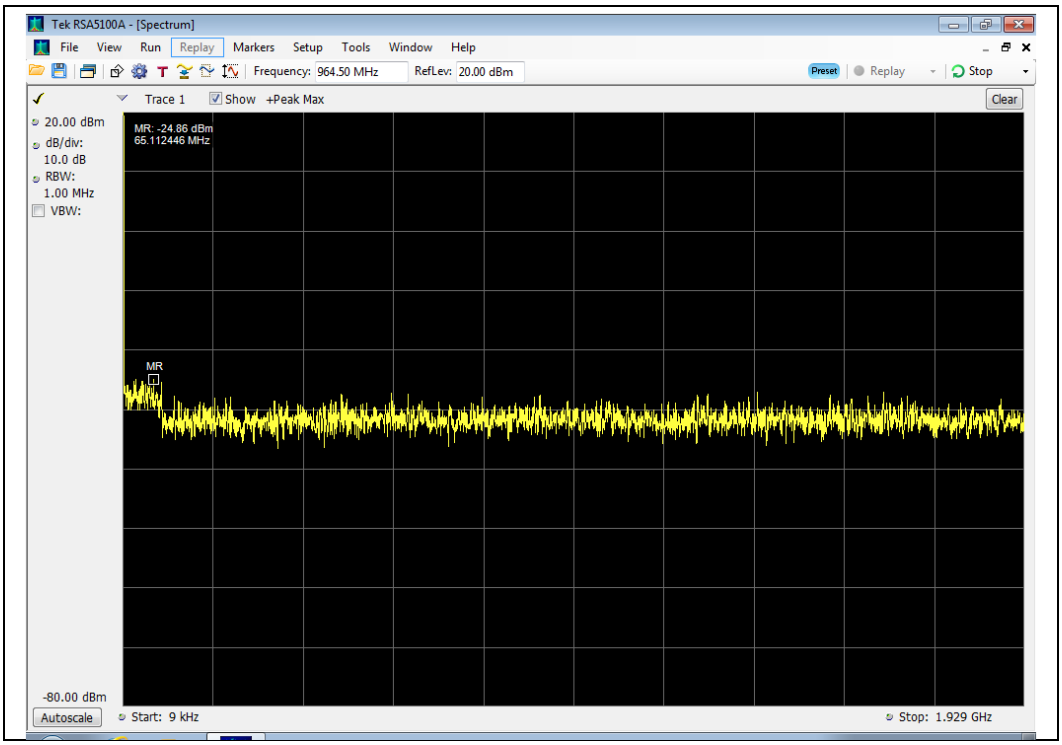


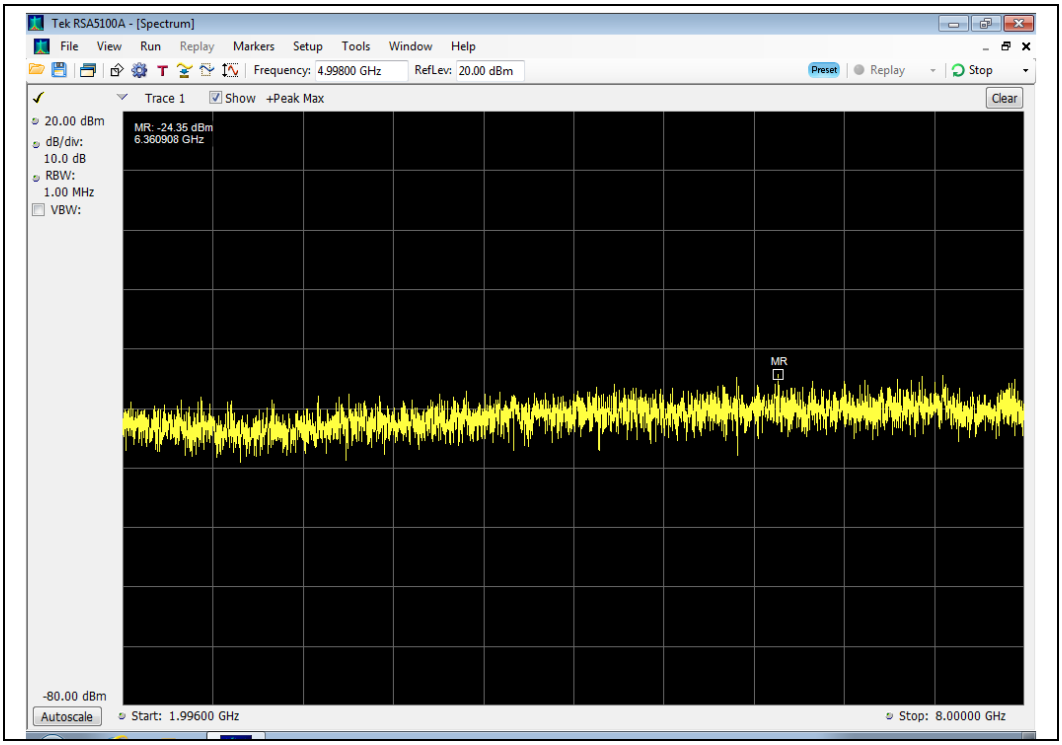
869 - 894 MHz Band

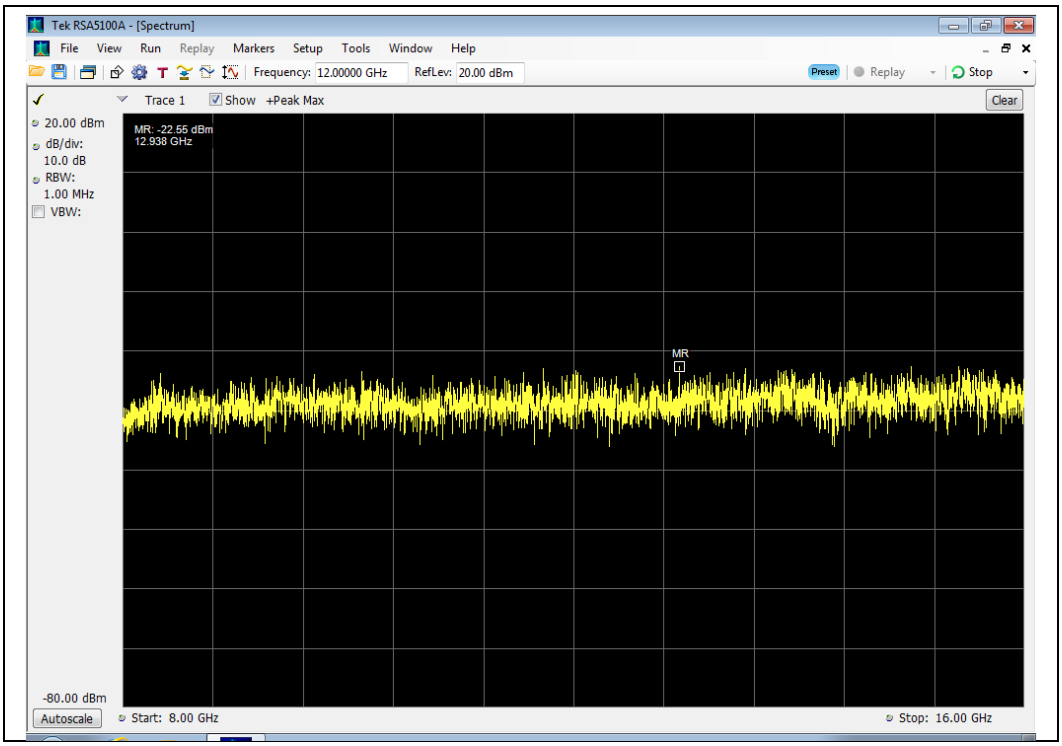


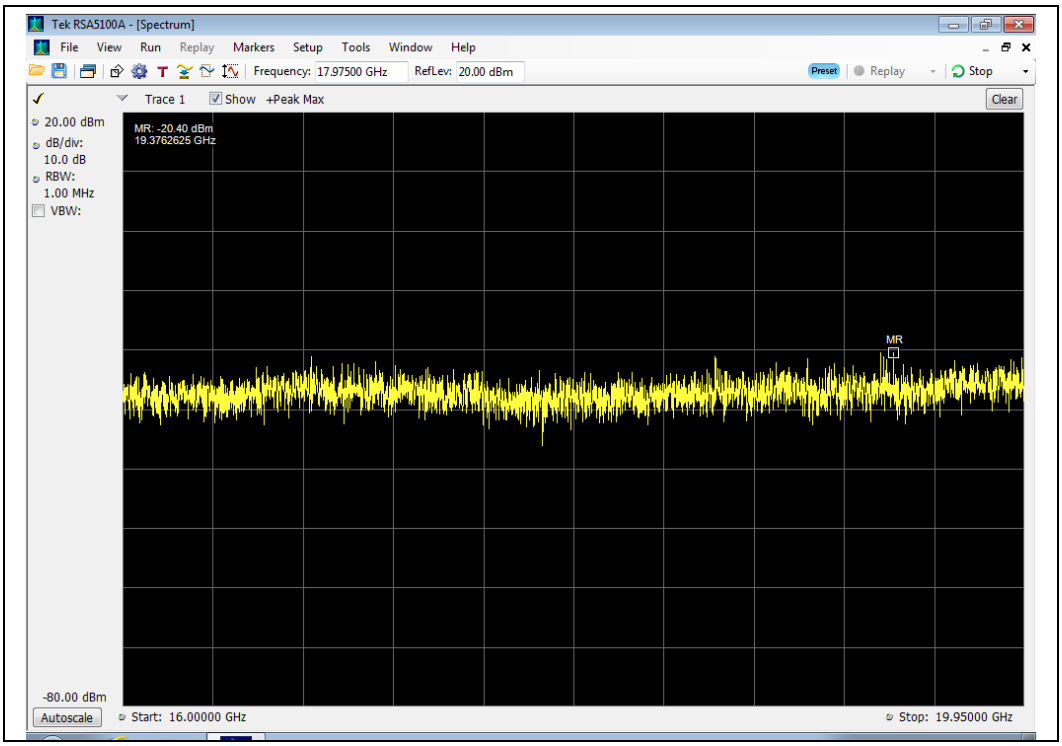


1930 - 1990 MHz Band






Tek RSA5100A - [Spectrum]
File View Run Replay Markers Setup Tools Window Help
Frequency: 12.00000 GHz
RefLev: 20.00 dBm
Preset
Replay
Stop
Trace 1
Show
+Peak Max
Clear
20.00 dBm
dB/div:
10.0 dB
RBW:
1.00 MHz
VBW:
MR: -22.55 dBm
12.938 GHz
MR
-80.00 dBm
Autoscale
Start: 8.00 GHz
Stop: 16.00 GHz


Tek RSA5100A - [Spectrum]
File View Run Replay Markers Setup Tools Window Help
Frequency: 17.97500 GHz
RefLev: 20.00 dBm
Preset
Replay
Stop
Trace 1
Show
+Peak Max
Clear
20.00 dBm
dB/div:
10.0 dB
RBW:
1.00 MHz
VBW:
MR: -20.40 dBm
19.3762625 GHz
MR
-80.00 dBm
Autoscale
Start: 16.00000 GHz
Stop: 19.95000 GHz

Noise Limits

Name of Test:	Noise Limits	**Engineer:**	Greg Corbin
Test Equipment Utilized:	i00413, i00424 SMU 200A - S/N:101369	**Test Date:**	11/25/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure that accurate readings were obtained. A series of three tests were performed: the maximum uplink and downlink noise, the variable noise for the uplink and downlink in the presence of a downlink signal, and the variable uplink noise timing. The detailed procedures from KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516c were followed.

For the Uplink Noise Timing plots, the first marker (MR) is the reference marker where the Downlink signal level was increased and marker (M1) is the time it took the booster to react to the increase in the Downlink signal level per KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516c.

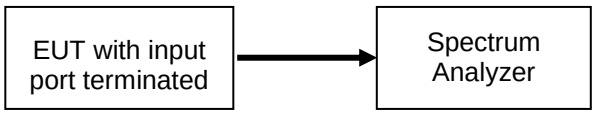
The following formulas are used for calculating the limits. Note – Downlink noise power limit is calculated with the CF of the associated uplink band.

Noise Power =-102.5+LOG10(Band Center Frequency)*20

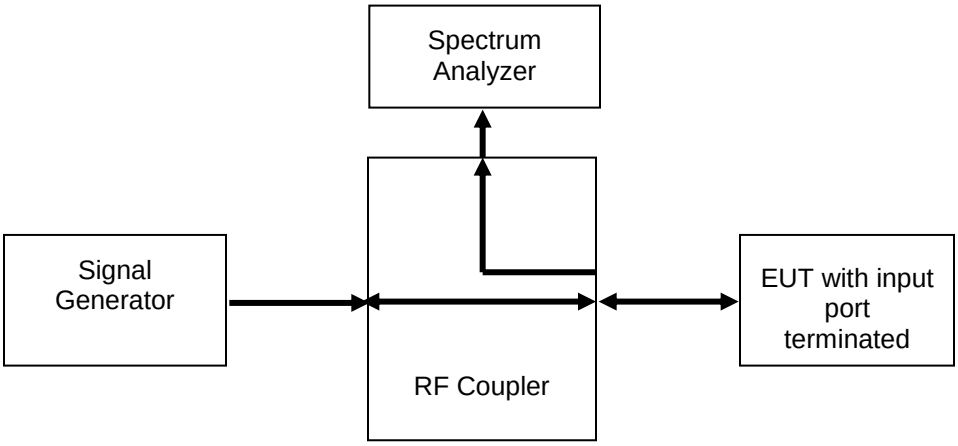
Variable Noise =-103 dBm/MHz-RSSI

Test Setup

Maximum Noise Power



Variable Uplink Noise Power and Timing



Variable Downlink Noise Power and Timing

Maximum Uplink Noise Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
698 - 716	-49.1	-45.5	-3.6	Pass
824 - 849	-47	-44.1	-2.9	Pass
1850 - 1910	-42.8	-37.0	-5.8	Pass

Maximum Downlink Noise Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
728 - 746	-50.4	-45.5	-4.9	Pass
869 - 894	-47.5	-44.1	-3.4	Pass
1930 - 1990	-42.7	-37.0	-5.7	Pass

Uplink Noise Timing Test Results

Frequency Band (MHz)	Measured Timing (Seconds)	Limit (Seconds)	Result
698 - 716	0.50	3.0	Pass
824 - 849	0.60	3.0	Pass
1710 - 1755	0.55	3.0	Pass

Variable Uplink Noise Limit Test Results

698 - 716 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-74.0	-45.5	-48.1	-2.6
-73.0	-45.5	-48.1	-2.6
-72.0	-45.5	-48.1	-2.6
-71.0	-45.5	-48.1	-2.6
-46.0	-57.0	-67.2	-10.2
-49.0	-54.0	-64.5	-10.5

824 - 849 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-74.0	-44.0	-46.3	-2.3
-73.0	-44.0	-46.3	-2.3
-72.0	-44.0	-46.3	-2.3
-71.0	-44.0	-46.3	-2.3
-46.0	-57.0	-64.2	-7.2
-45.0	-58.0	-65.3	-7.3

1850 - 1910 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-75.0	-37.0	-42.2	-5.2
-78.0	-37.0	-42.5	-5.5
-77.0	-37.0	-42.5	-5.5
-76.0	-37.0	-42.5	-5.5
-53.0	-50.0	-59.4	-9.4
-56.0	-47.0	-56.5	-9.5

Variable Downlink Noise Limit Test Results

728 - 746 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-67.0	-45.5	-49.9	-4.4
-65.0	-45.5	-50.2	-4.7
-72.0	-45.5	-50.3	-4.8
-71.0	-45.5	-50.3	-4.8
-50.0	-53.0	-64.1	-11.1
-52.0	-51.0	-62.7	-11.7

869 - 894 MHz

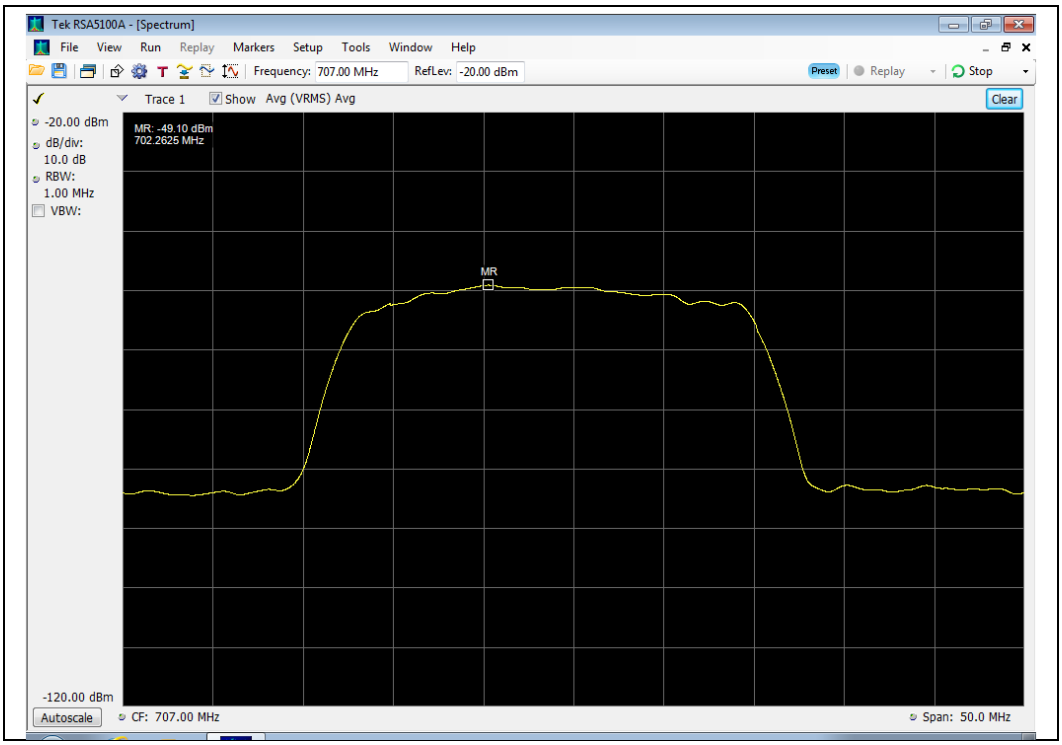
RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-69.0	-44.0	-46.0	-2.0
-73.0	-44.0	-46.6	-2.6
-72.0	-44.0	-46.6	-2.6
-71.0	-44.0	-46.6	-2.6
-56.0	-47.0	-56.9	-9.9
-52.0	-51.0	-61.0	-10.0

1930 - 1990 MHz

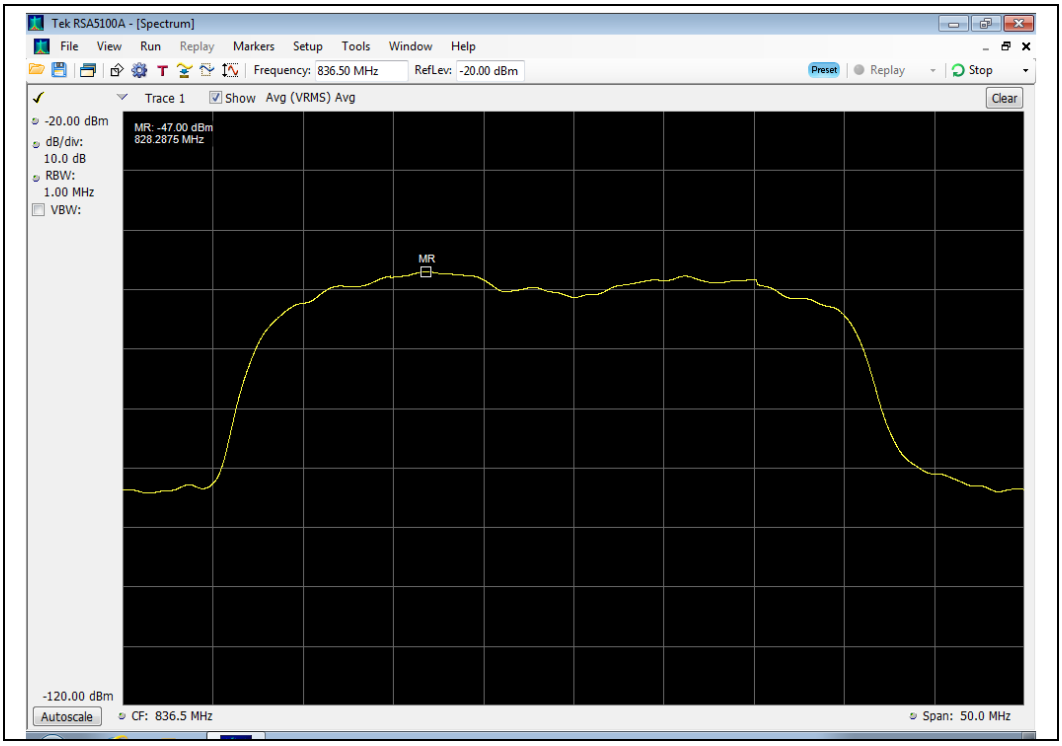
RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-68.0	-37.0	-41.9	-4.9
-71.0	-37.0	-42.3	-5.3
-72.0	-37.0	-42.3	-5.3
-73.0	-37.0	-42.3	-5.3
-56.0	-47.0	-53.6	-6.6
-58.0	-45.0	-51.8	-6.8

Maximum Uplink Noise Test Plots

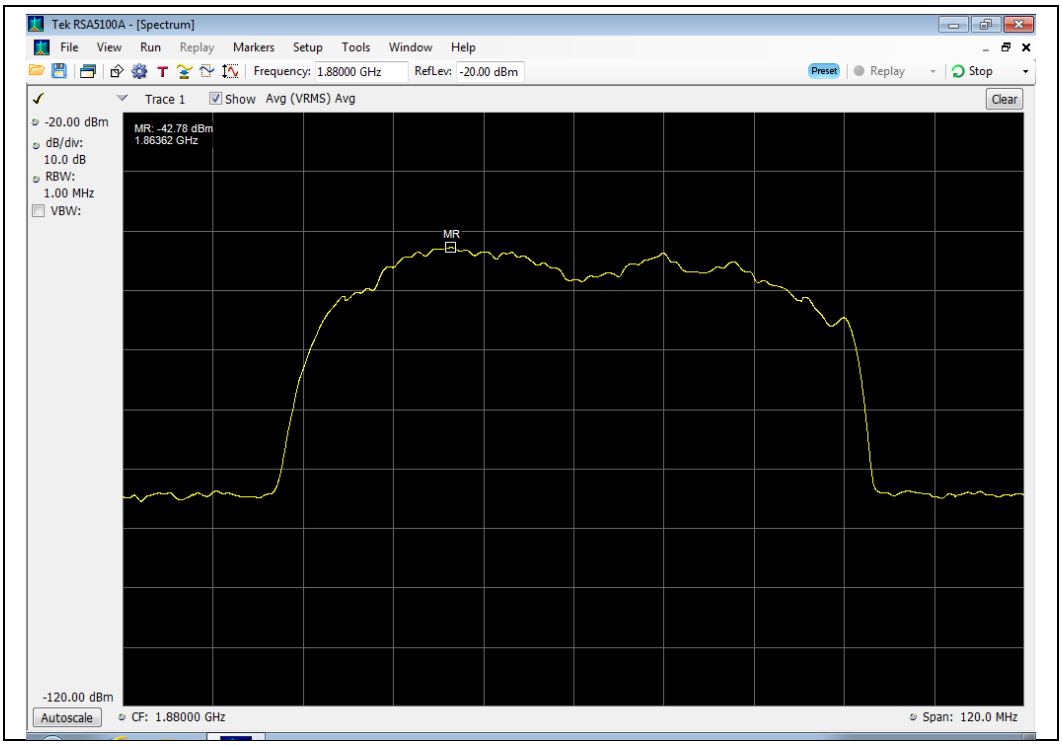
698 - 716 MHz Band



824 - 849 MHz Band

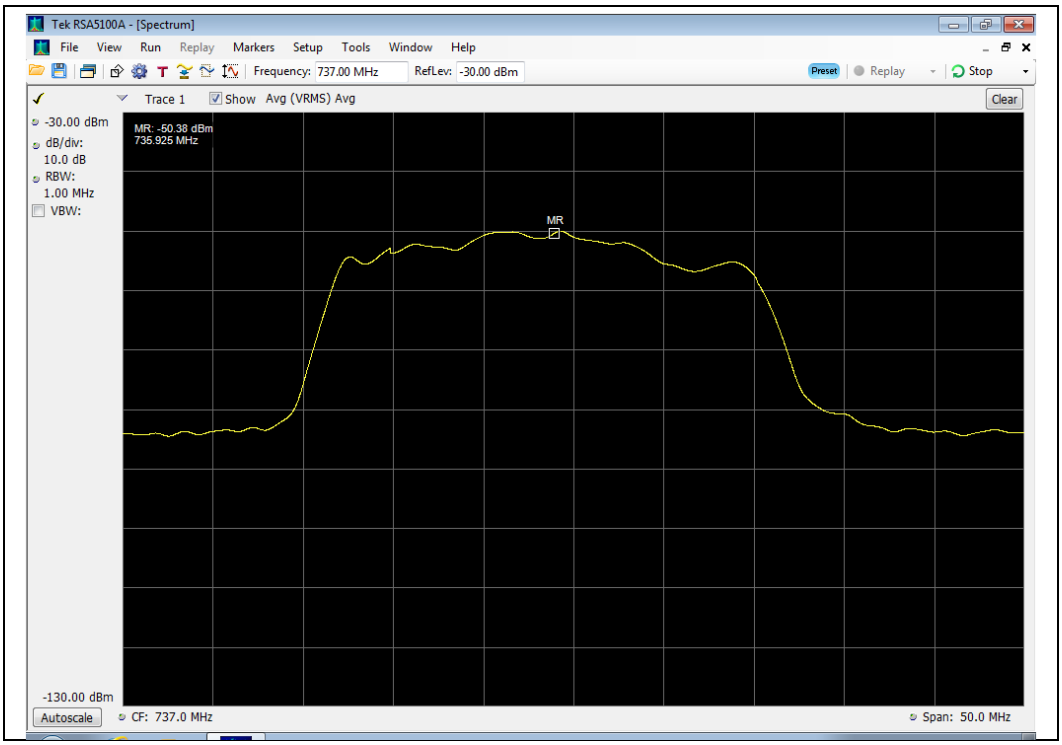


1850 - 1910 MHz Band

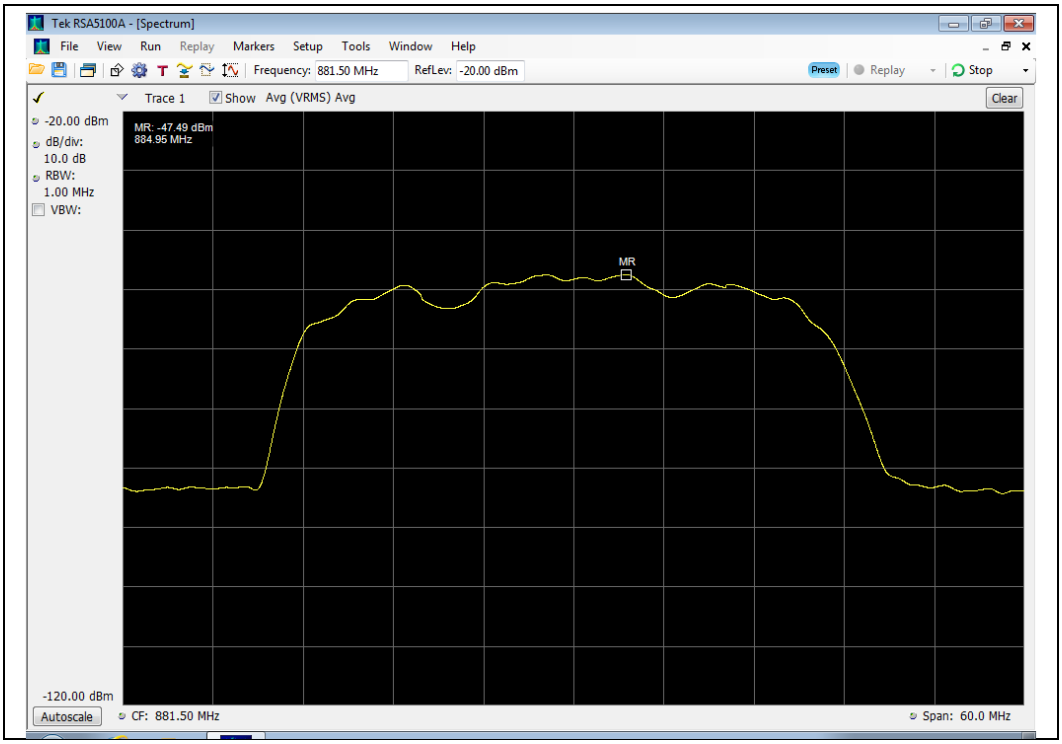


Maximum Downlink Noise Test Plots

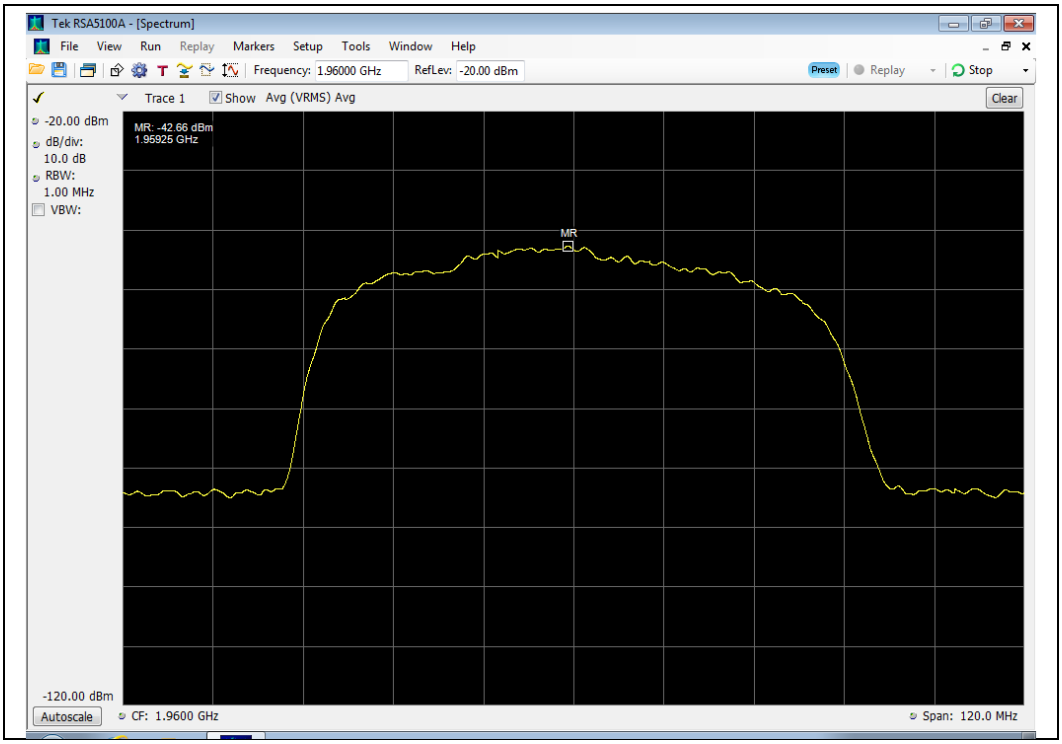
728 - 746 MHz Band



869 - 894 MHz Band

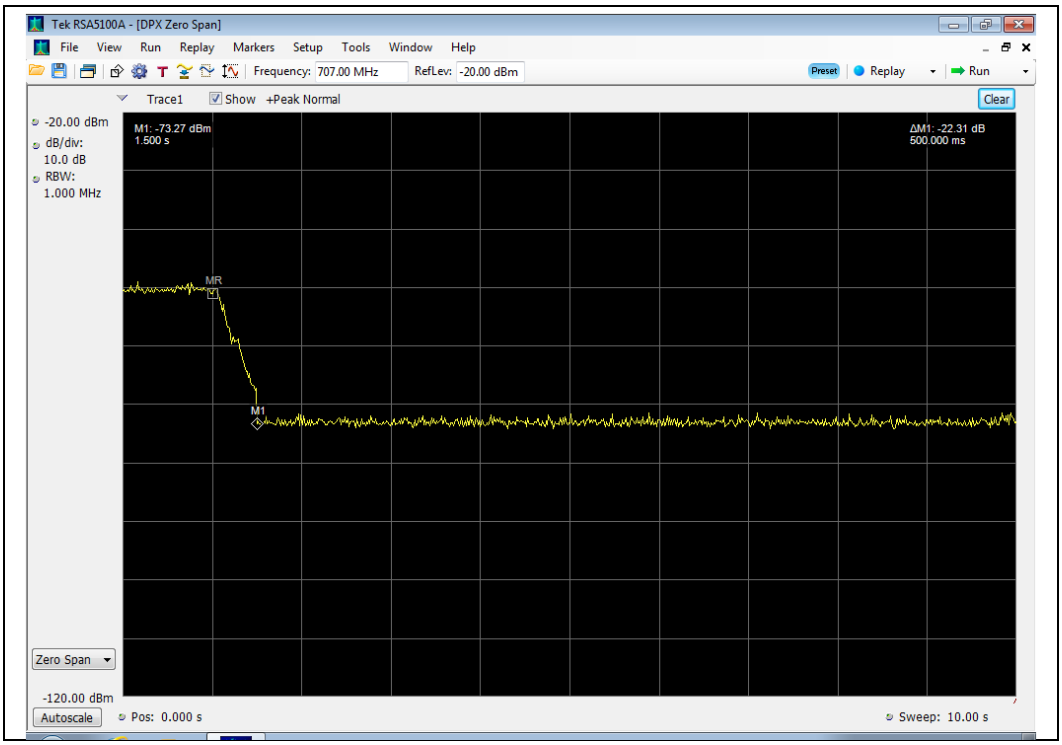


1930 - 1990 MHz Band

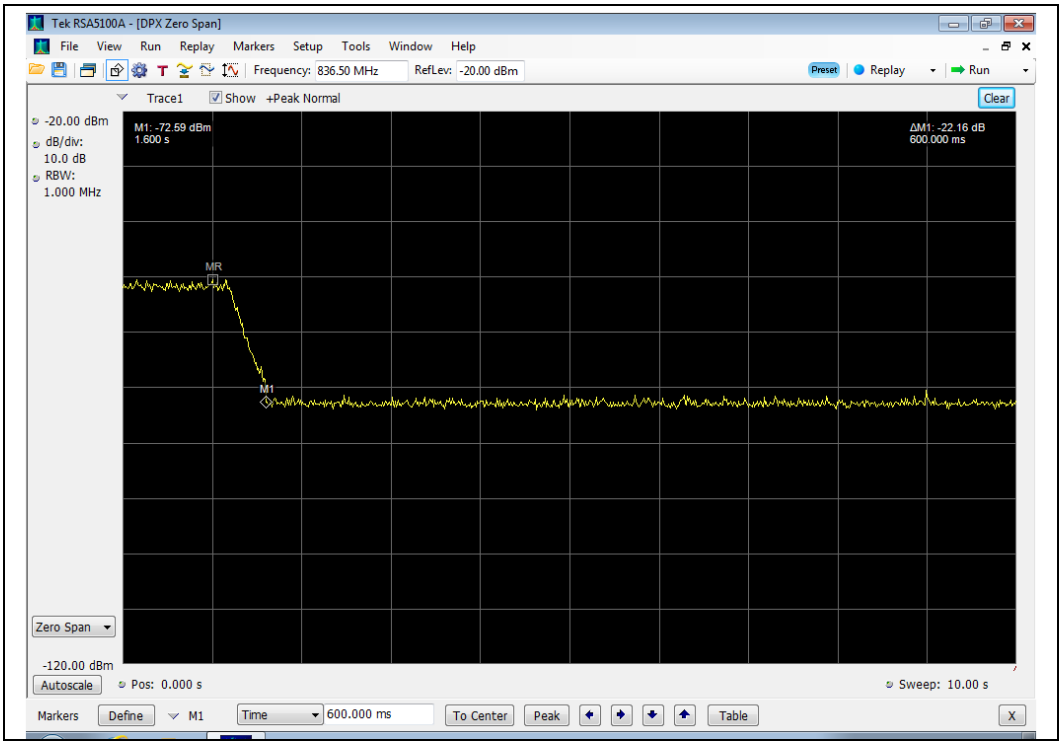


Uplink Noise Timing Test Plots

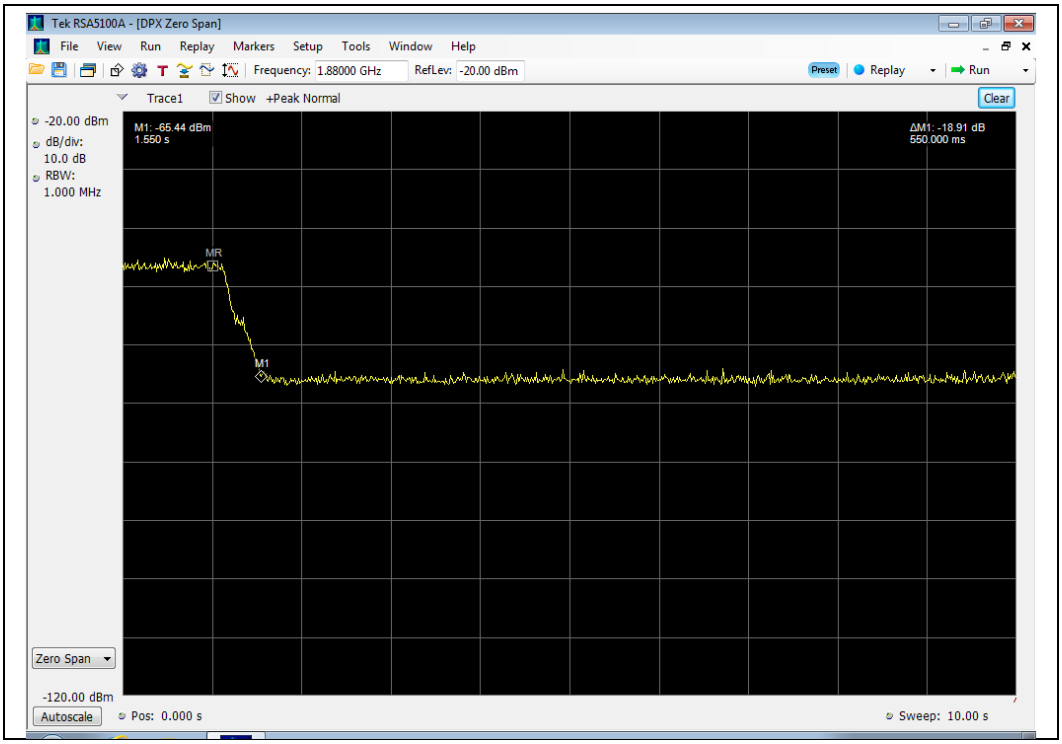
698 - 716 MHz Band



824 - 849 MHz Band



1850 - 1910 MHz Band



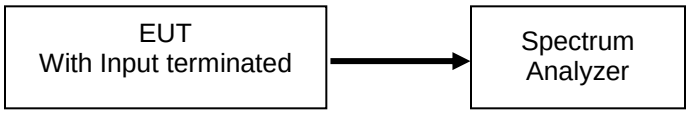
Uplink Inactivity

Name of Test: Uplink Inactivity
Engineer: Greg Corbin
Test Equipment Utilized: i00424
Test Date: 11/25/2013

Test Procedure

The EUT was connected directly to a spectrum analyzer set to operate in the center of the EUT operational uplink and downlink bands. The span was set to 0 Hz with a sweep time of 330 seconds and MAX HOLD operation. The EUT was powered on and the time for the uplink to return to an inactive state was measured using the DELTA MARKER method to ensure that it was less than 300 seconds. The noise level after the return to an inactive state was less than -70 dBm/MHz.

Test Setup

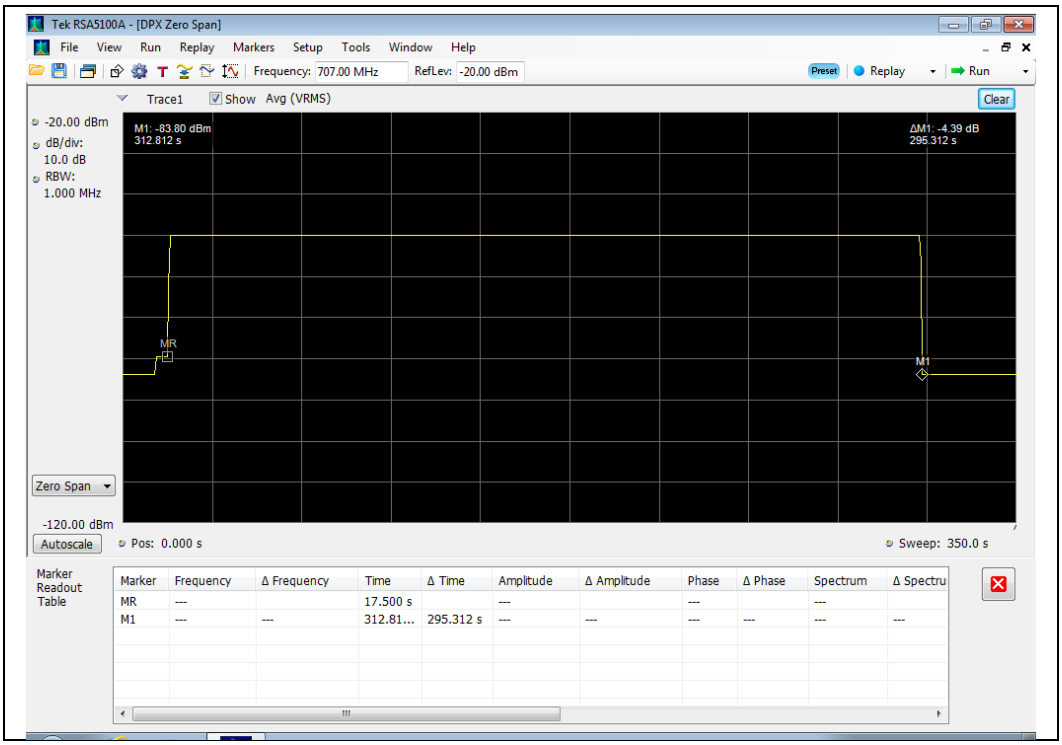


Uplink Test Results

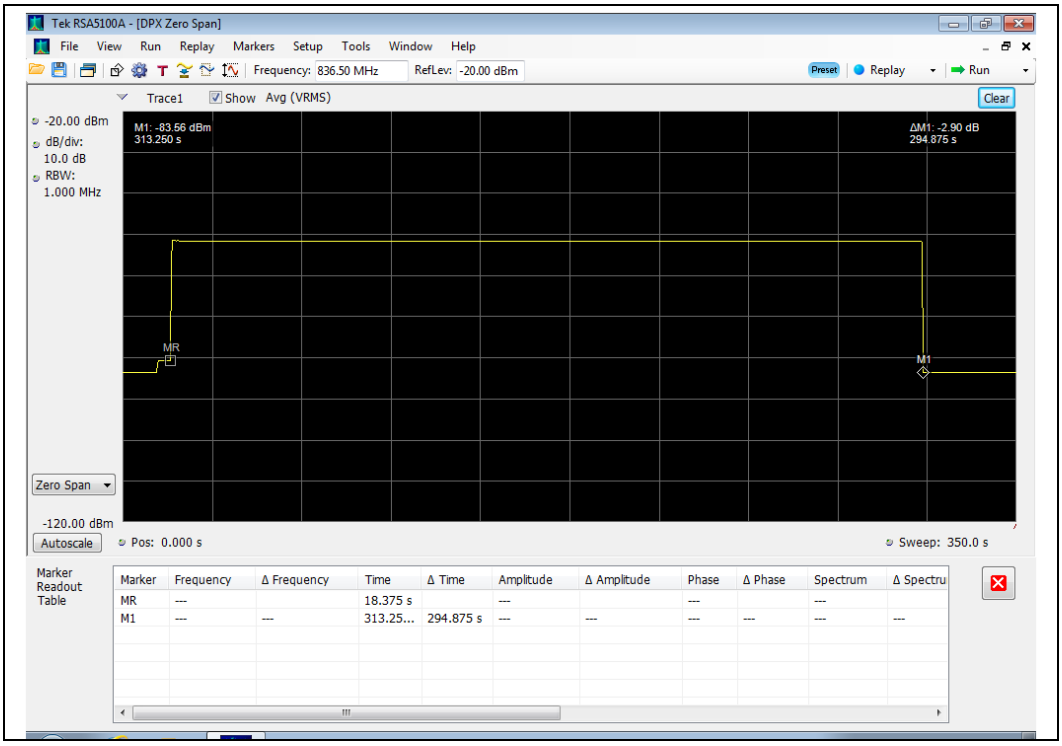
Frequency Band (MHz)	Measured Time (Seconds)	Limit (Seconds)	Result
698 - 716	295.312	300	Pass
824 - 849	294.875	300	Pass
1850 - 1910	294.875	300	Pass

Uplink Inactivity Test Results

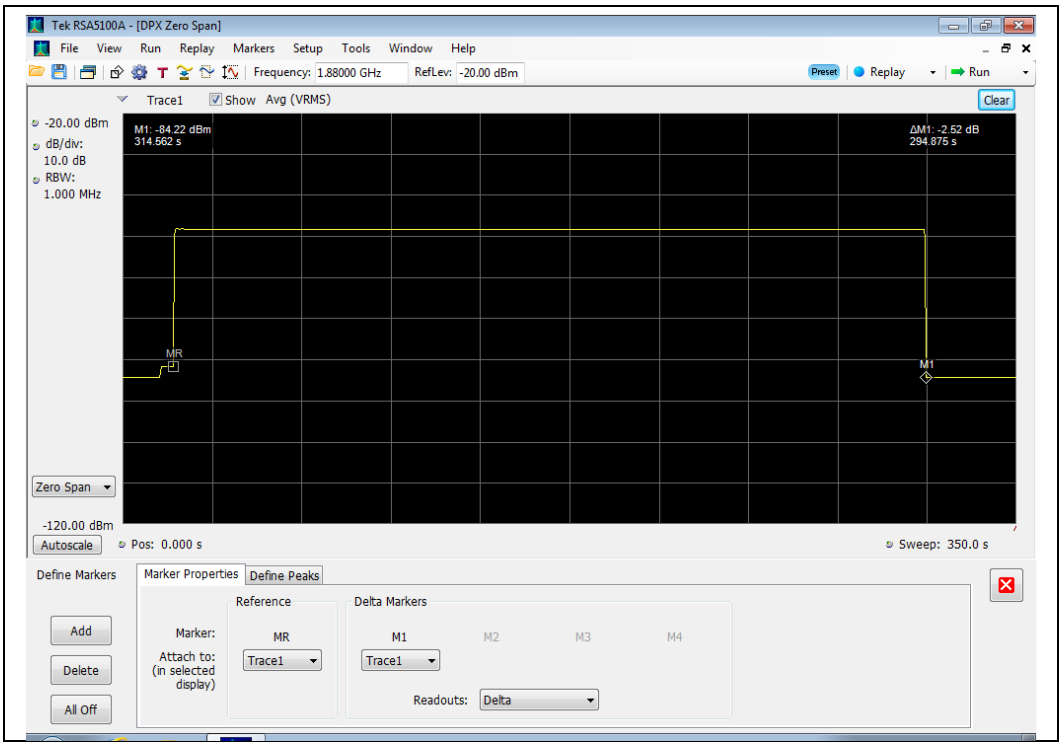
698 - 716 MHz



824 - 849 MHz



1850 - 1910 MHz



Variable Gain

Name of Test:	Variable Gain	**Engineer:**	Greg Corbin
Test Equipment Utilized:	i00413, i00424 SMU 200A - S/N:101369	**Test Date:**	11/28/13

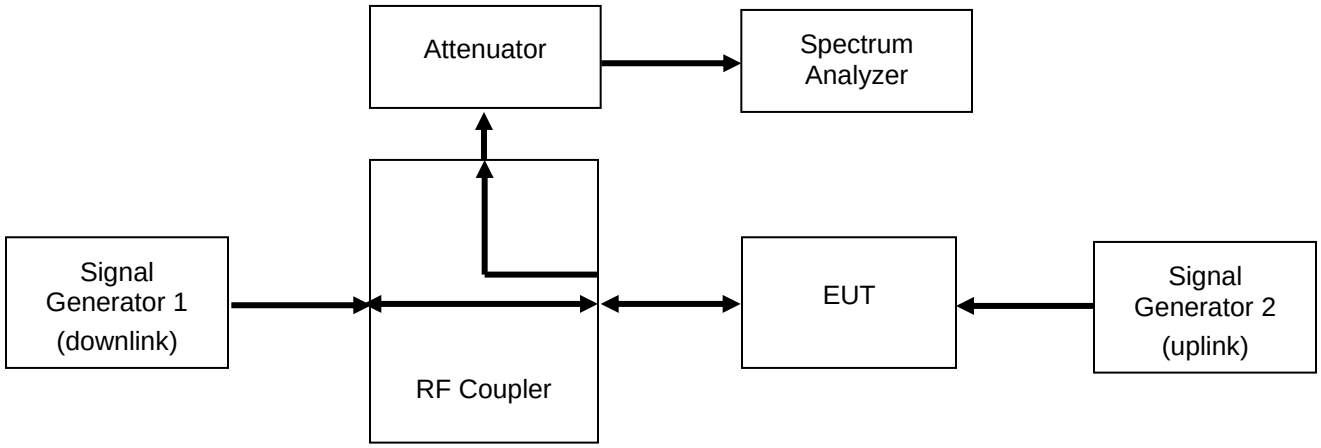
Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor in order to ensure accurate readings were obtained. The uplink gain in the presence of a downlink signal was measured for each operational uplink band using the detailed procedures from KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516.

The following formula is used for calculating the limits:

Variable Gain = -34 dB - RSSI +MSCL

Test Setup



Uplink Test Results

698 - 716 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-46	30.4	42.4	-48.1	-7.3	40.8	-1.6
-47	30.4	43.4	-48.1	-6.5	41.6	-1.8
-48	30.4	44.4	-48.1	-5.6	42.5	-1.9
-50	30.4	46.4	-48.1	-3.6	44.5	-1.9
-49	30.4	45.4	-48.1	-4.7	43.4	-2.0
-51	30.4	47.4	-48.1	-2.7	45.4	-2.0

824 - 849 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-45	31.9	42.9	-48.1	-8.3	39.8	-3.1
-46	31.9	43.9	-48.1	-7.5	40.6	-3.3
-47	31.9	44.9	-48.1	-6.8	41.3	-3.6
-44	31.9	41.9	-48.1	-9.9	38.2	-3.7
-48	31.9	45.9	-48.1	-6.0	42.1	-3.8
-49	31.9	46.9	-48.1	-6.0	42.1	-4.8

1850 - 1915 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-46	36.6	48.6	-49.9	-12.1	37.8	-10.8
-72	36.6	72.0	-49.9	11.2	61.1	-10.9
-73	36.6	72.0	-49.9	11.2	61.1	-10.9
-73	36.6	72.0	-49.9	11.2	61.1	-10.9
-75	36.6	72.0	-49.9	11.2	61.1	-10.9
-47	36.6	49.6	-49.9	-12.1	37.8	-11.8

Uplink Gain Timing Test Results

Frequency Band (MHz)	Measured Timing (Seconds)	Limit (Seconds)	Result
704 - 716	0.58	3.0	Pass
824 - 849	0.59	3.0	Pass
1850 - 1910	1.81	3.0	Pass

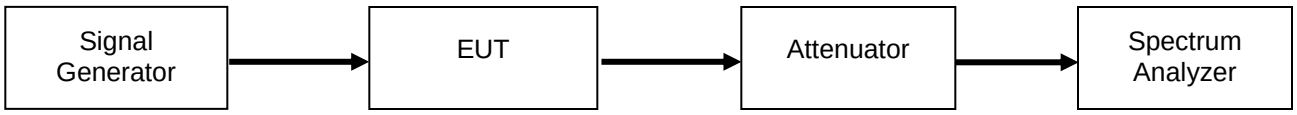
Occupied Bandwidth

Name of Test:	Occupied Bandwidth	**Engineer:**	Greg Corbin
Test Equipment Utilized:	i00424, SMU 200A - S/N:101369	**Test Date:**	11/25/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure that accurate readings were obtained. A signal generator was utilized to produce the following signals: GSM, CDMA, and WCDMA. The signal generator was tuned to the center channel of each the EUT operational uplink and downlink bands with the RF level set at a point just prior to the AGC being in control of the power. For each modulation type, the input and output signal was measured and plotted to ensure that the signals were similar.

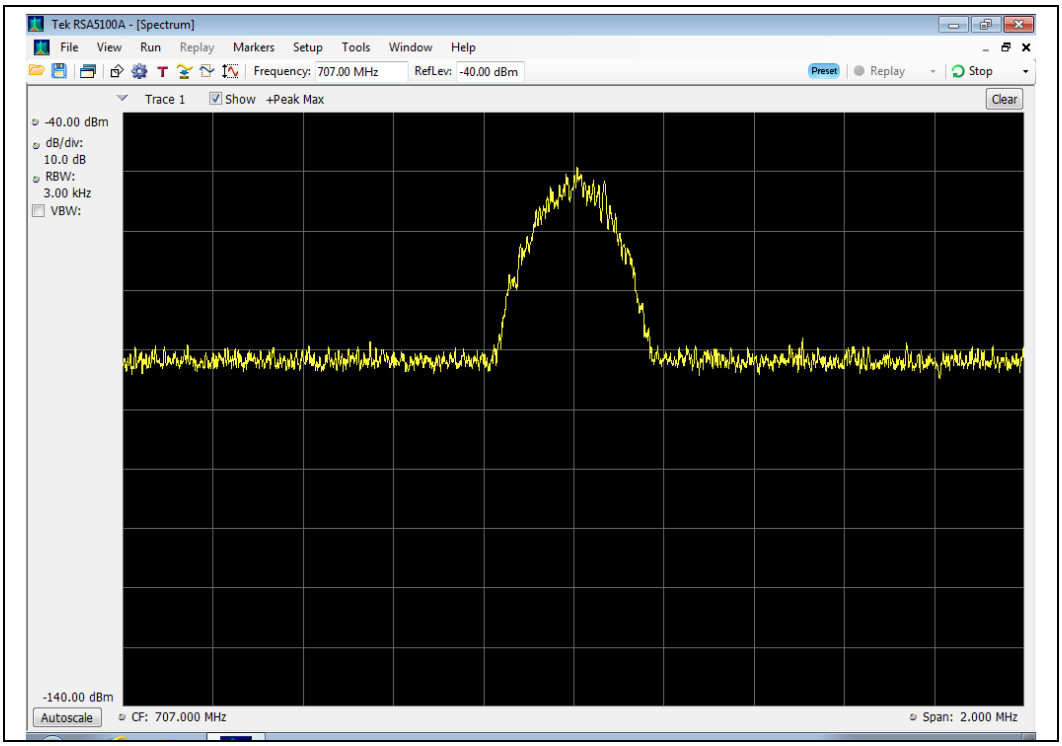
Test Setup



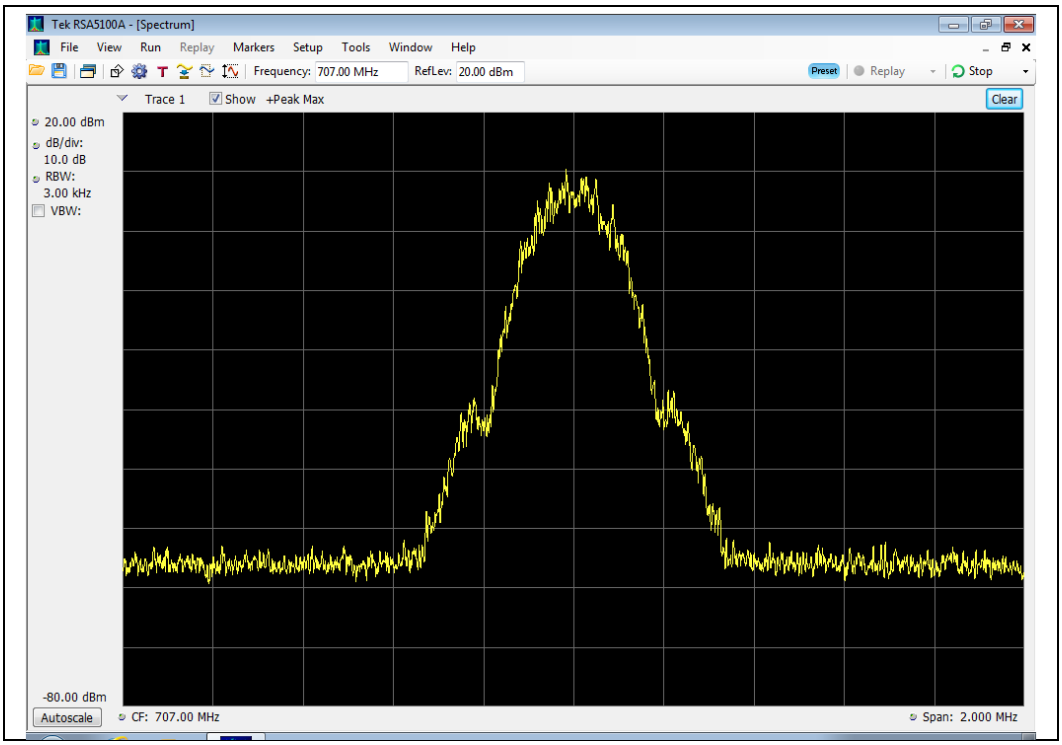
GSM Uplink Test Plots

698 - 716 MHz Band

Input

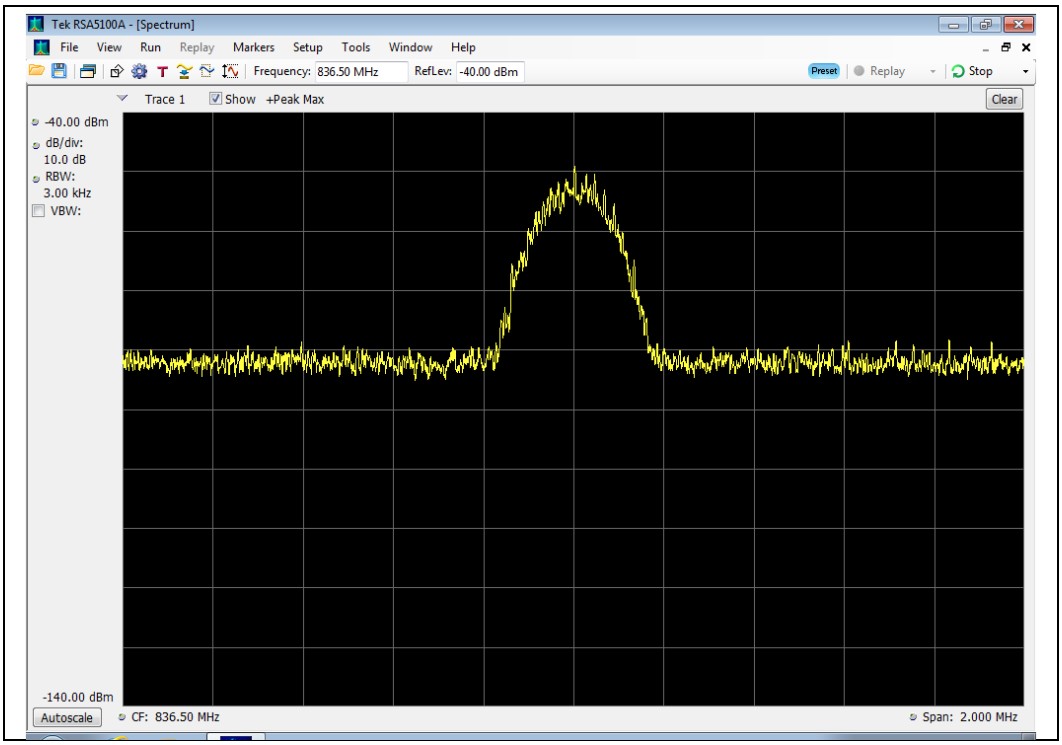


Output

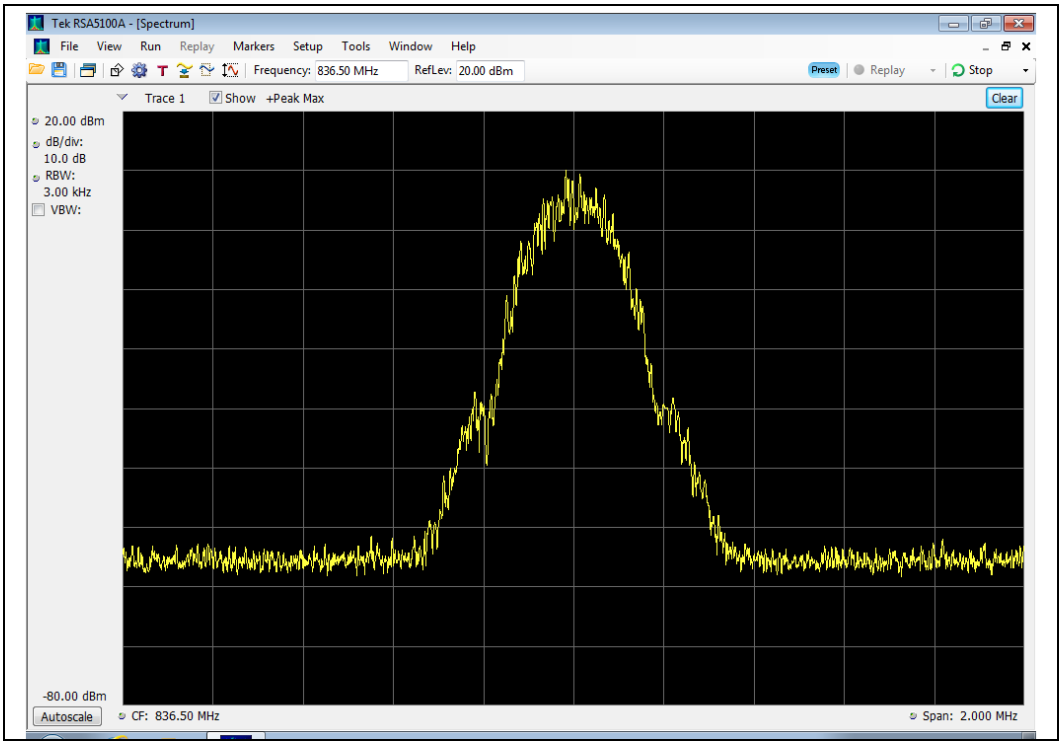


824 - 849 MHz Band

Input

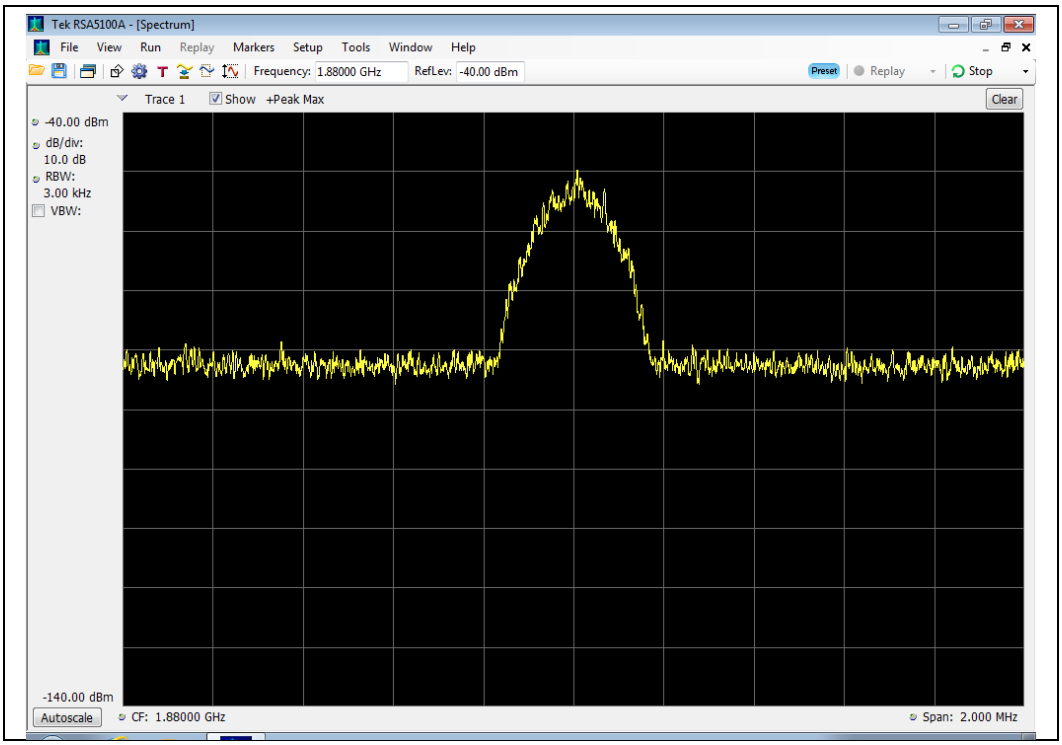


Output

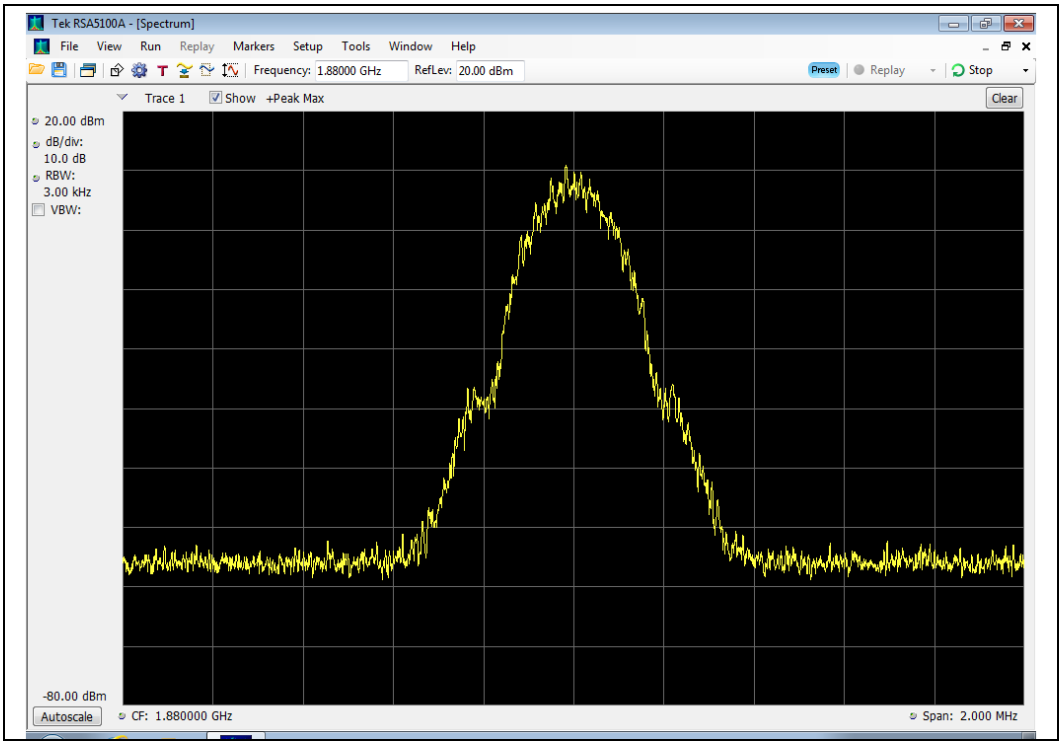


1850 - 1910 MHz Band

Input



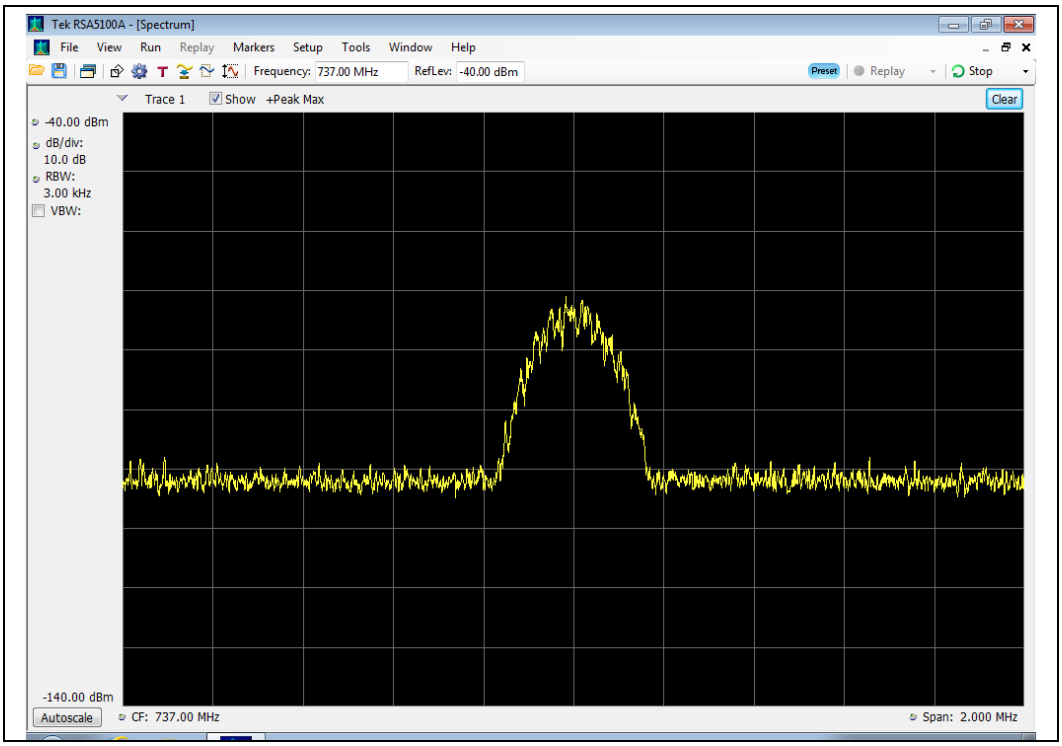
Output



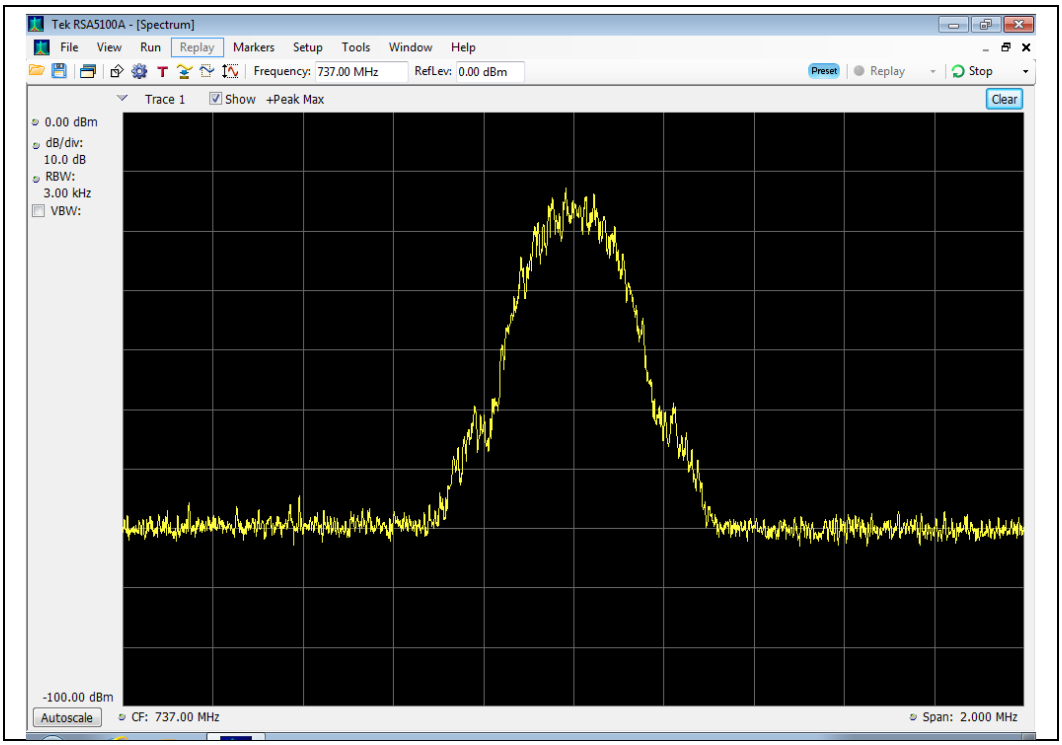
GSM Downlink Test Plots

728 - 746 MHz Band

Input

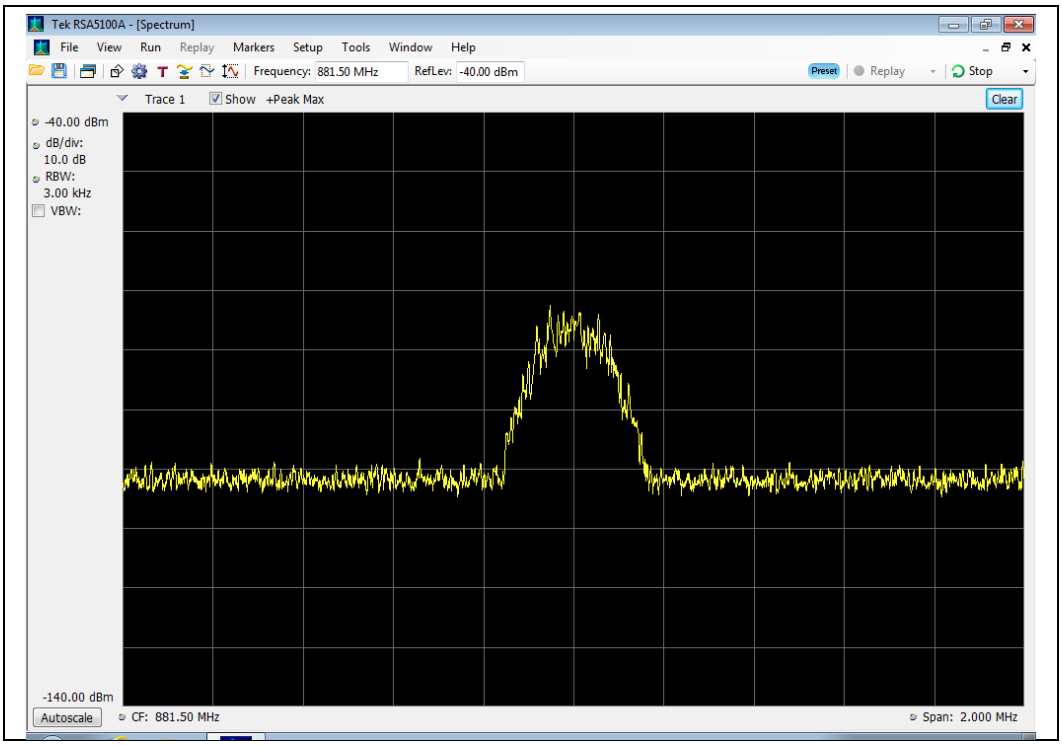


Output

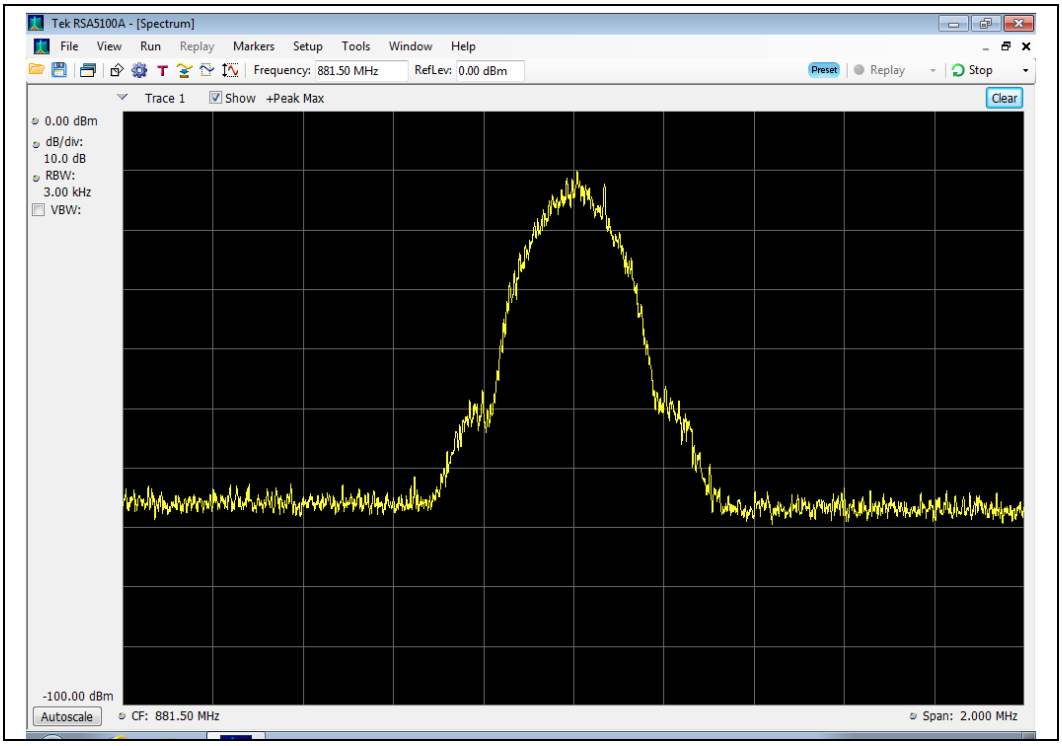


869 - 894 MHz Band

Input

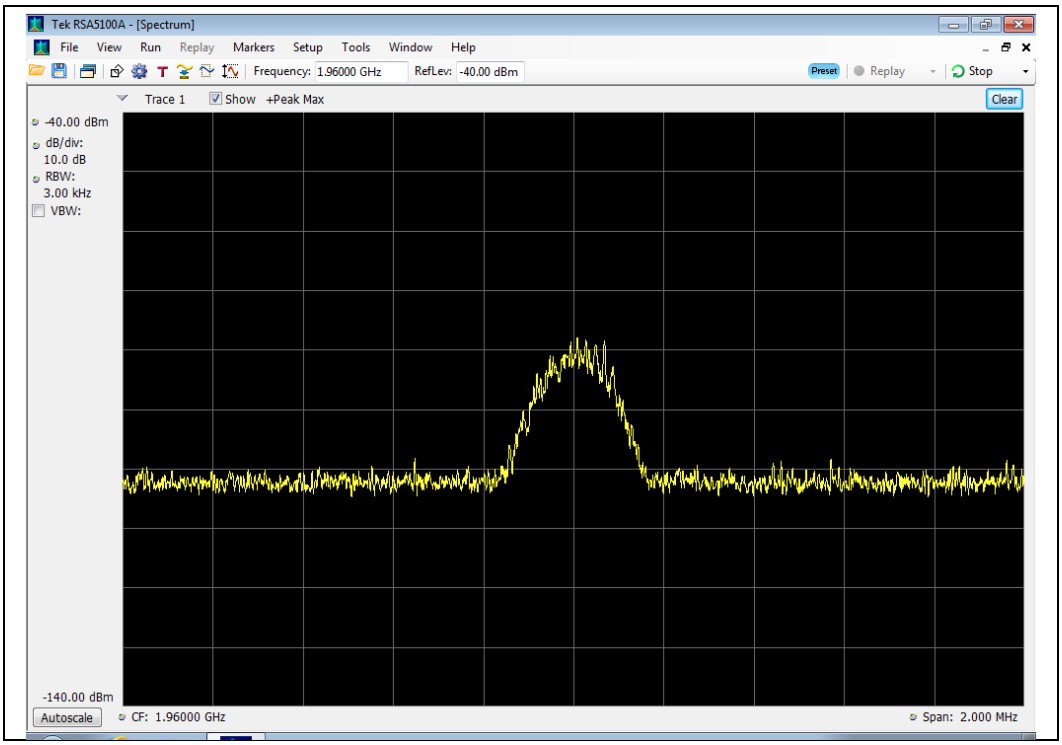


Output

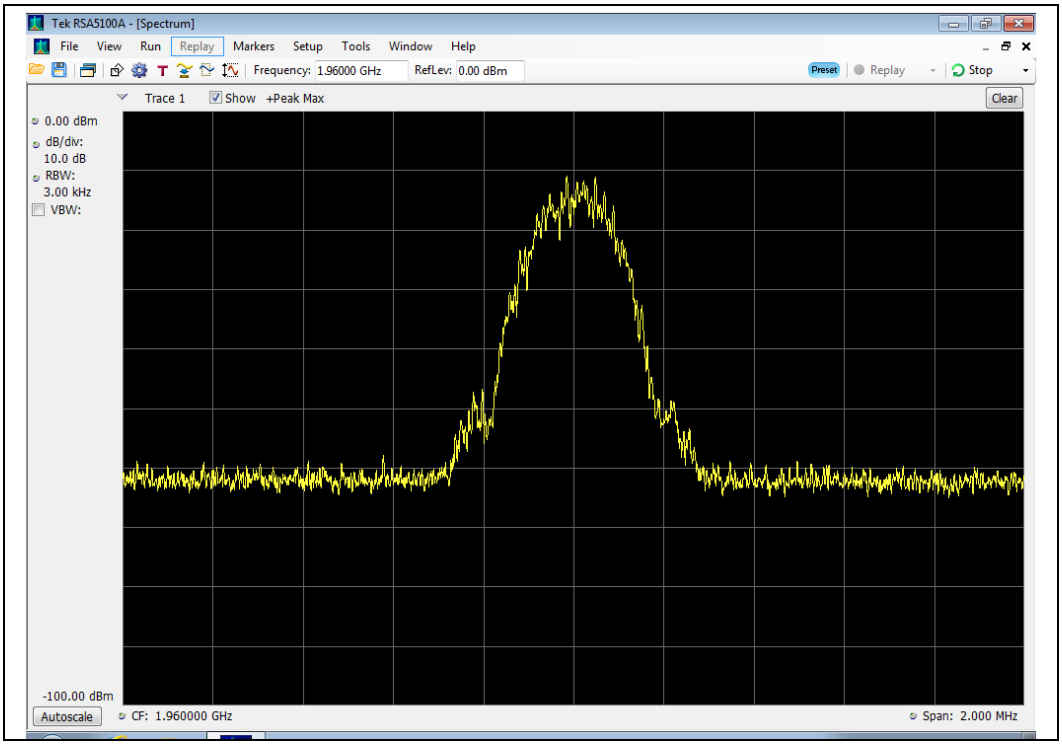


1930 - 1990 MHz Band

Input



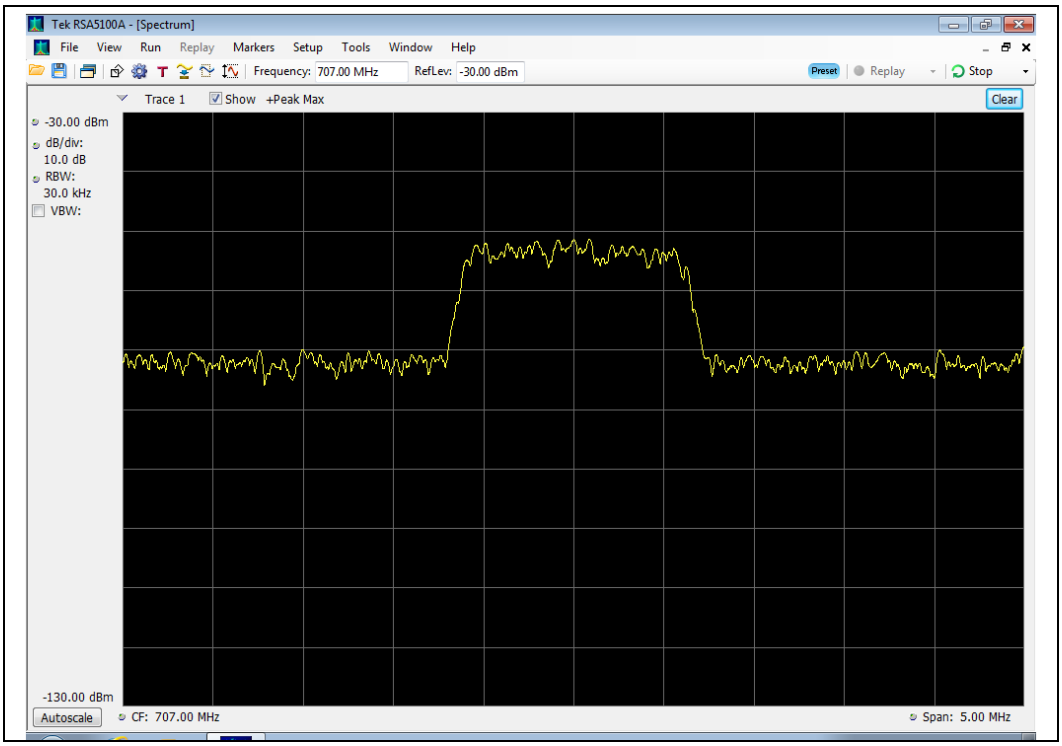
Output



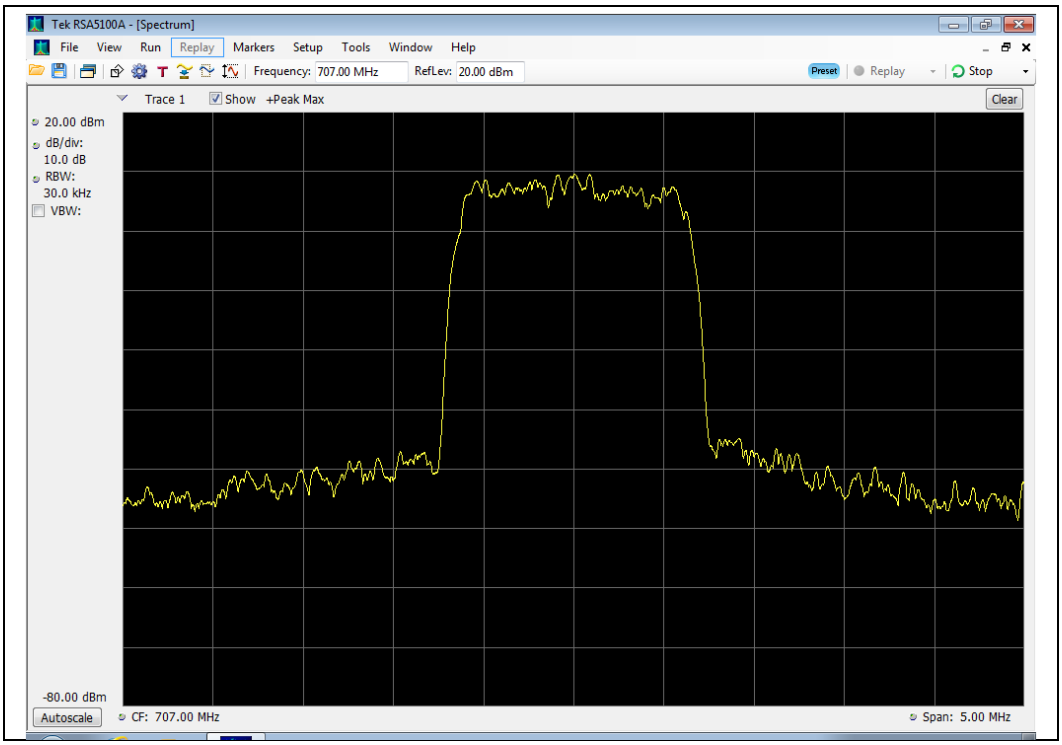
CDMA Uplink Test Plots

698 - 716 MHz Band

Input

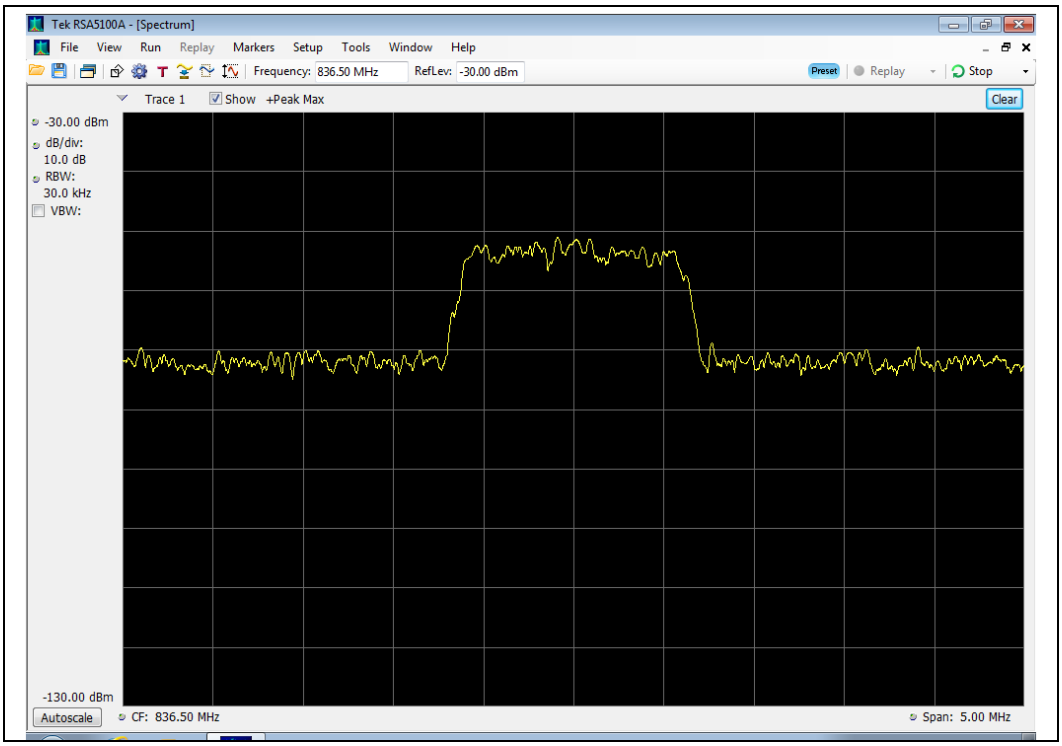


Output

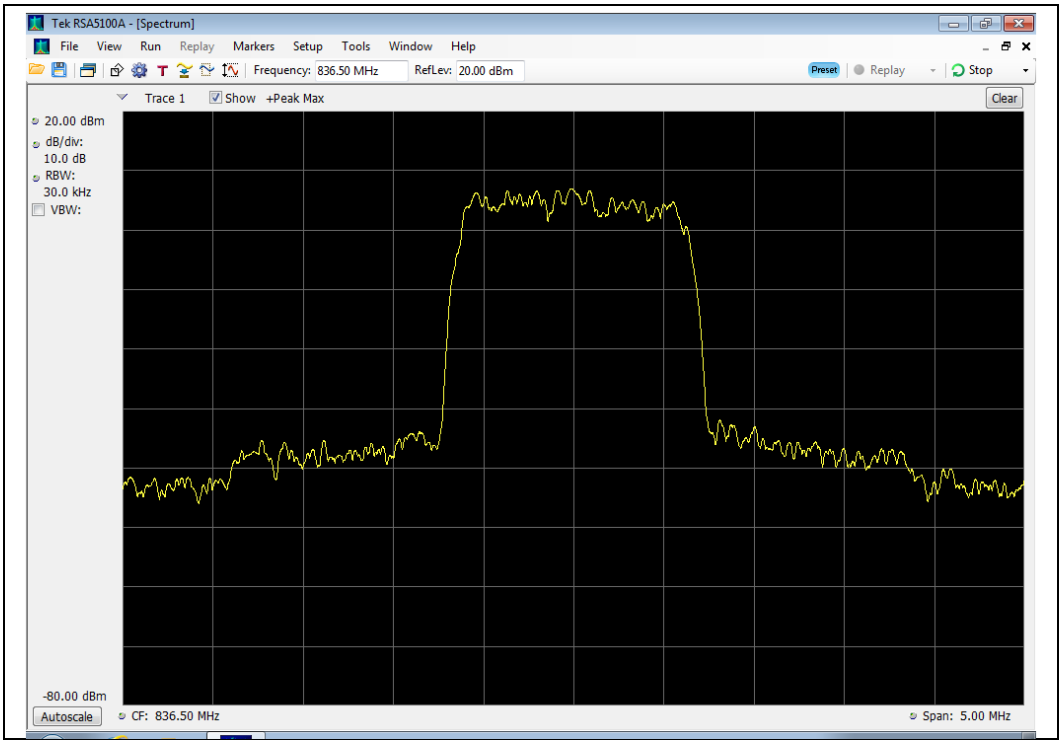


824 - 849 MHz Band

Input

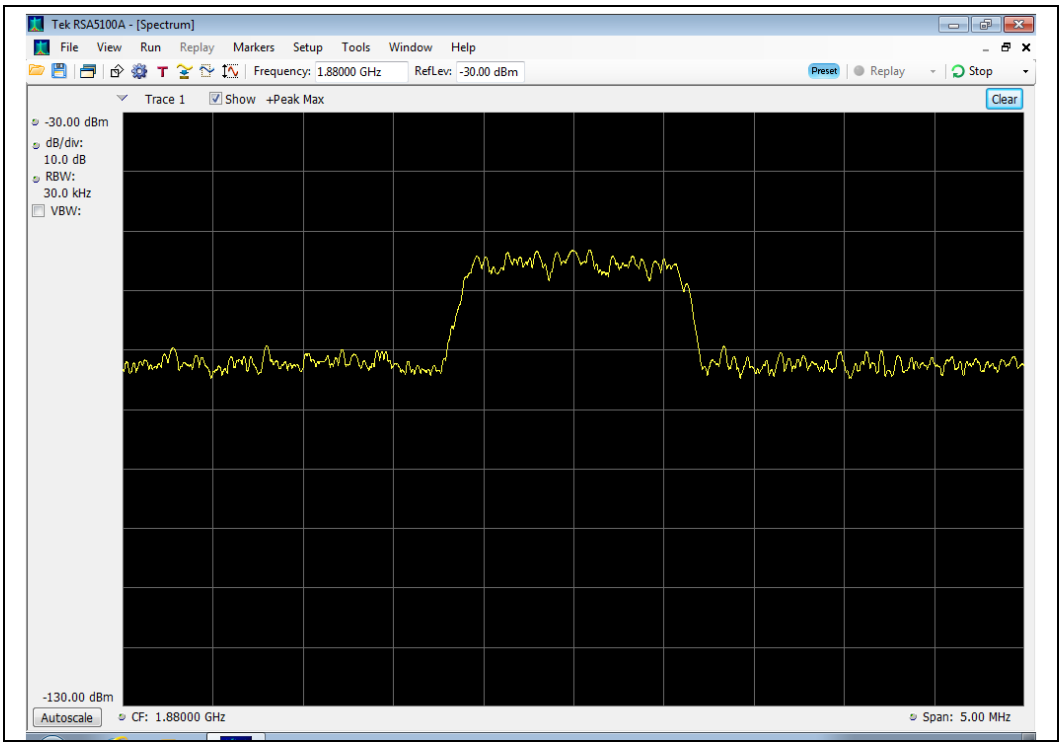


Output

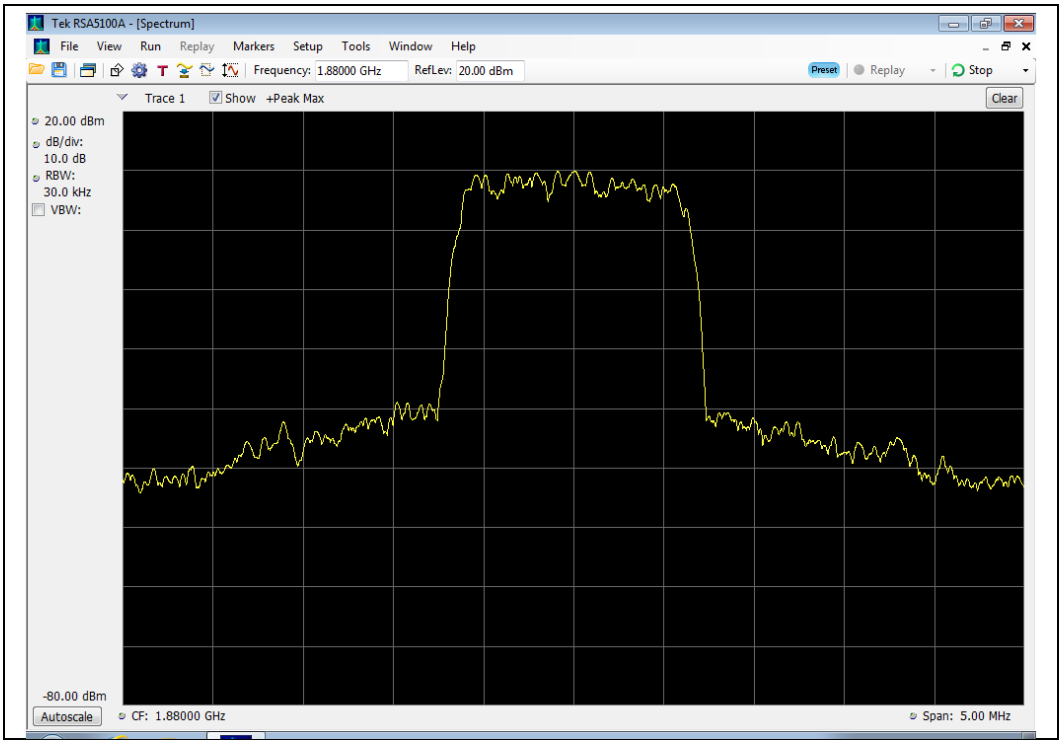


1850 - 1910 MHz Band

Input



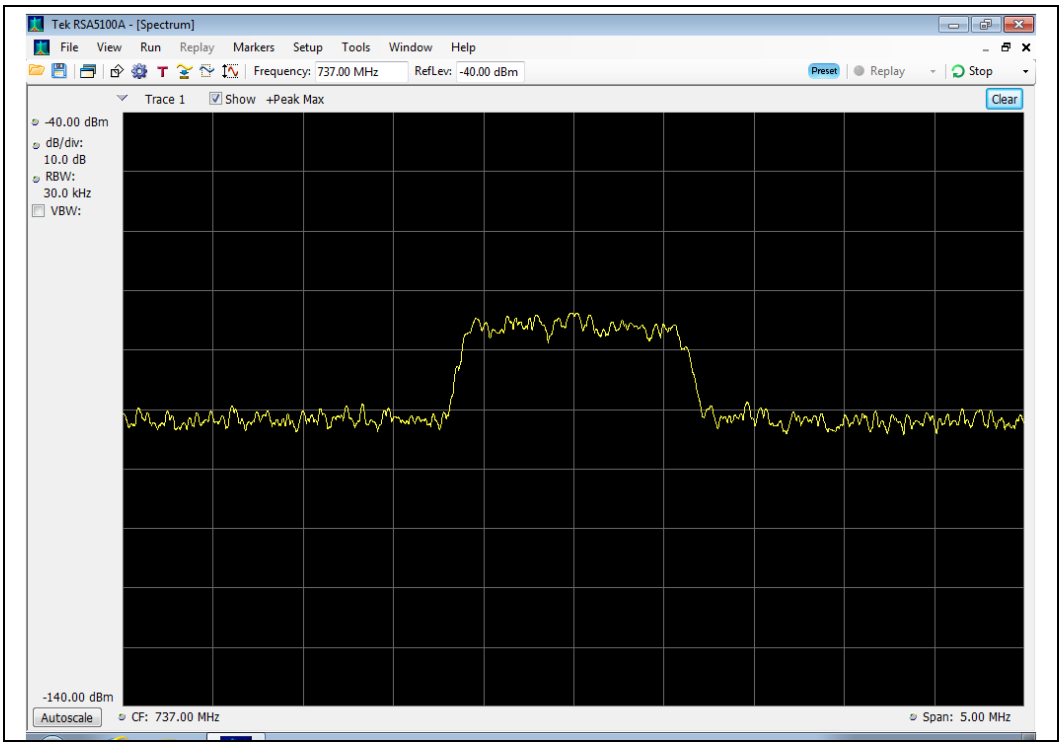
Output



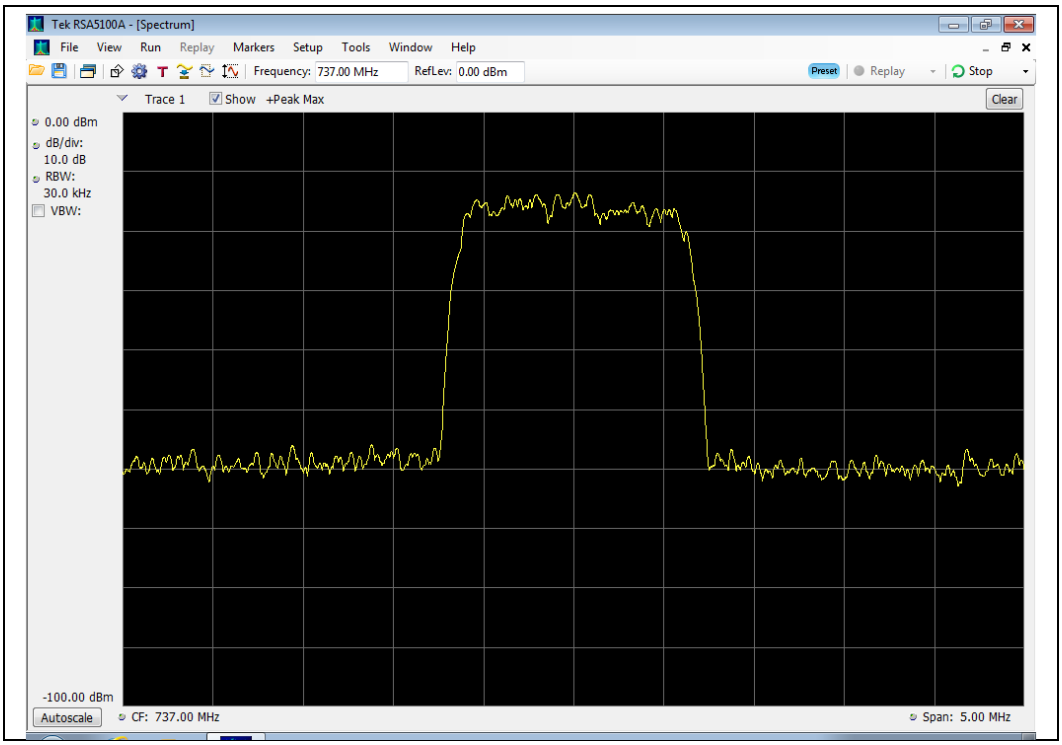
CDMA Downlink Test Plots

728 - 746 MHz Band

Input

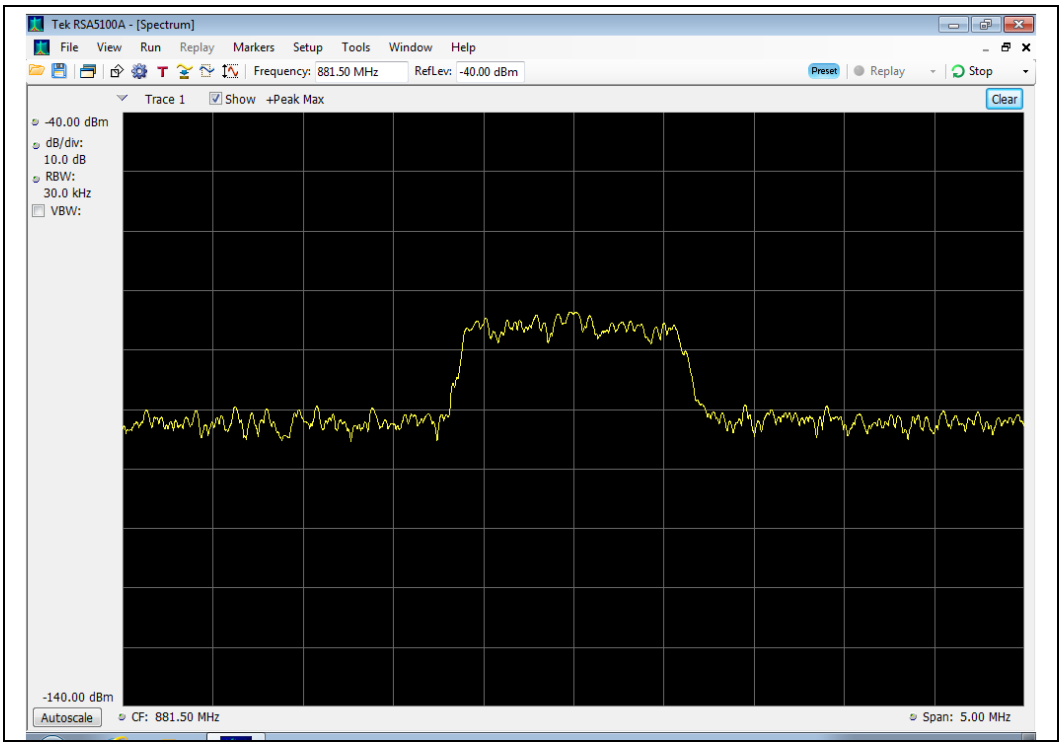


Output

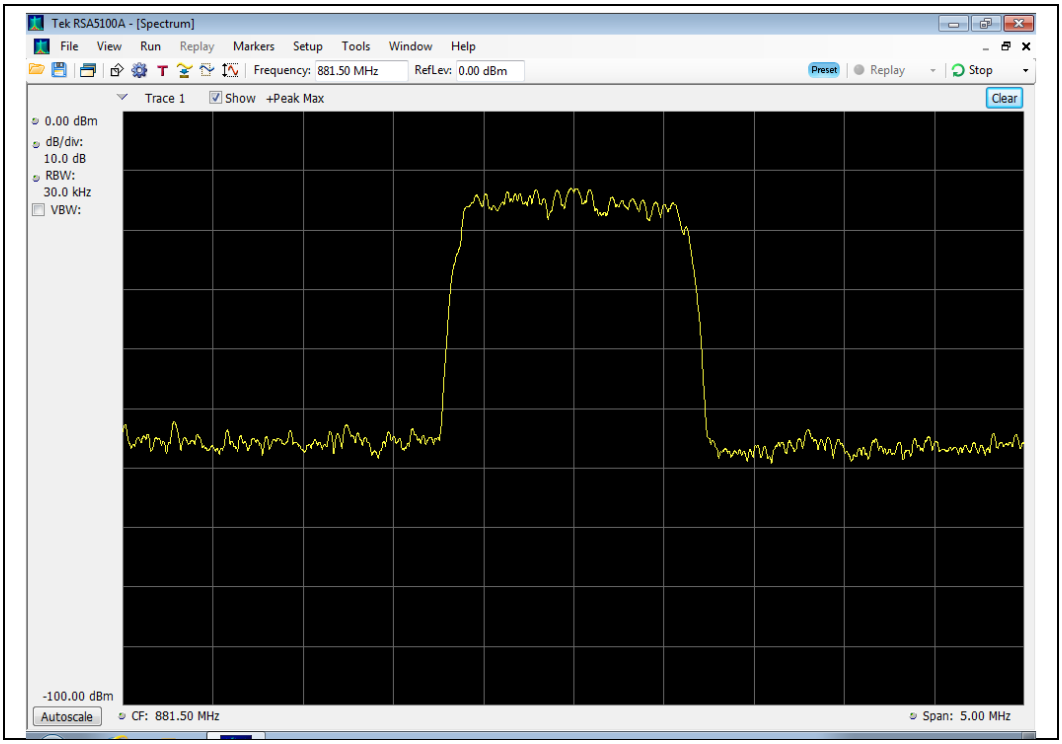


869 - 894 MHz Band

Input

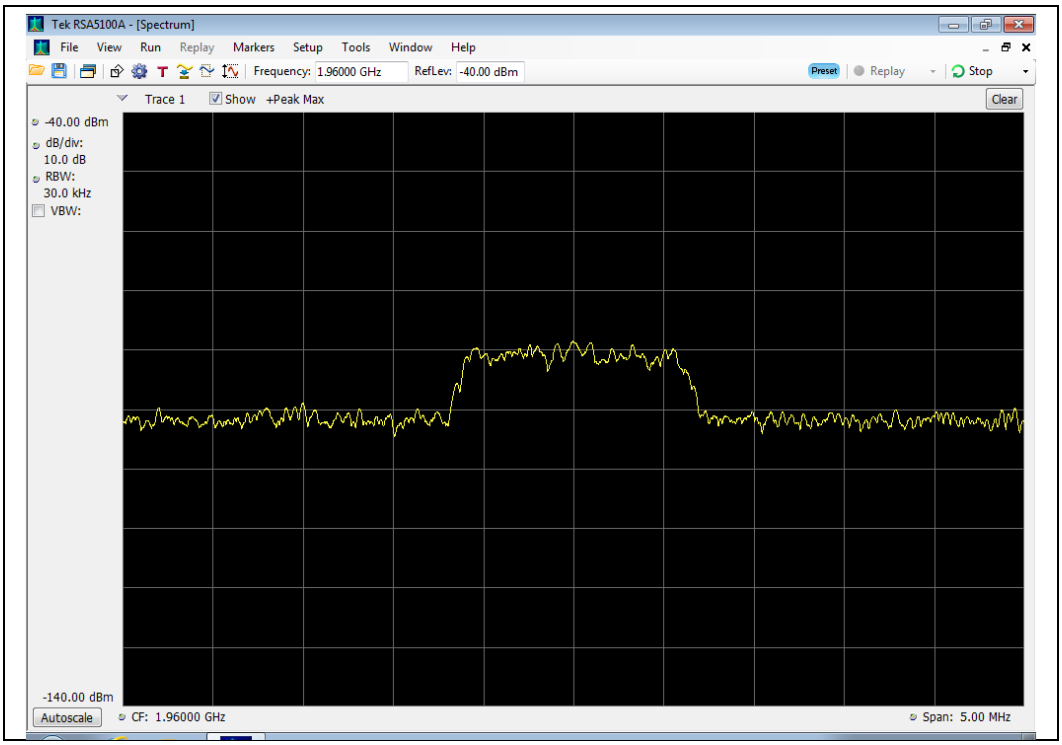


Output

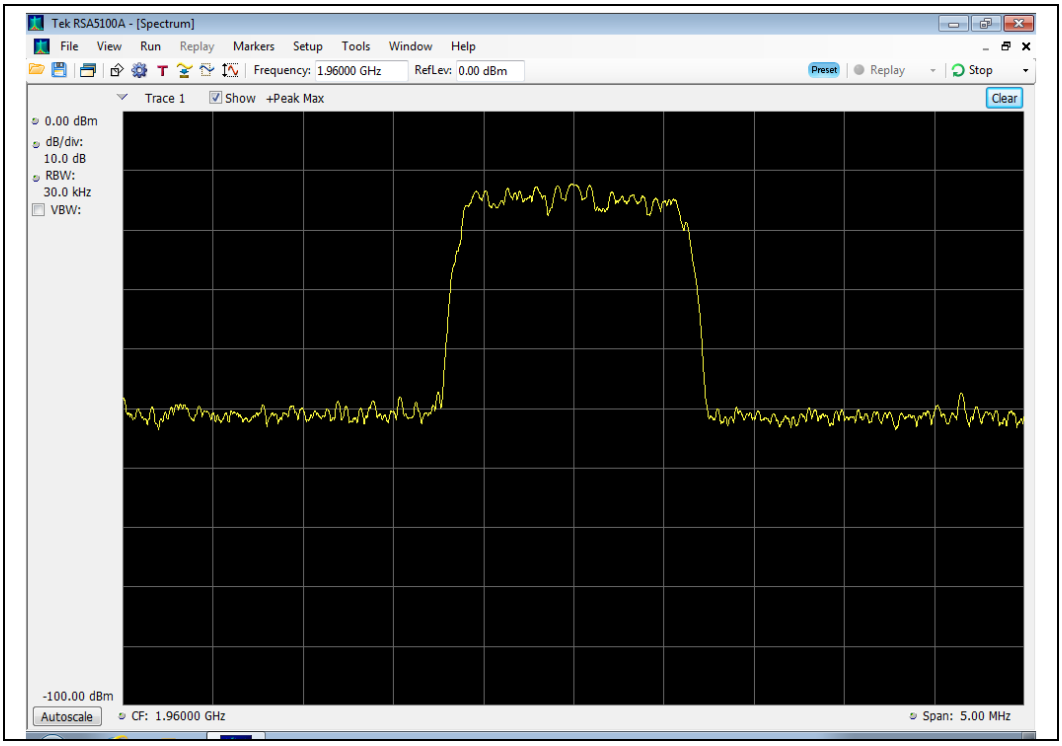


1930 - 1990 MHz Band

Input



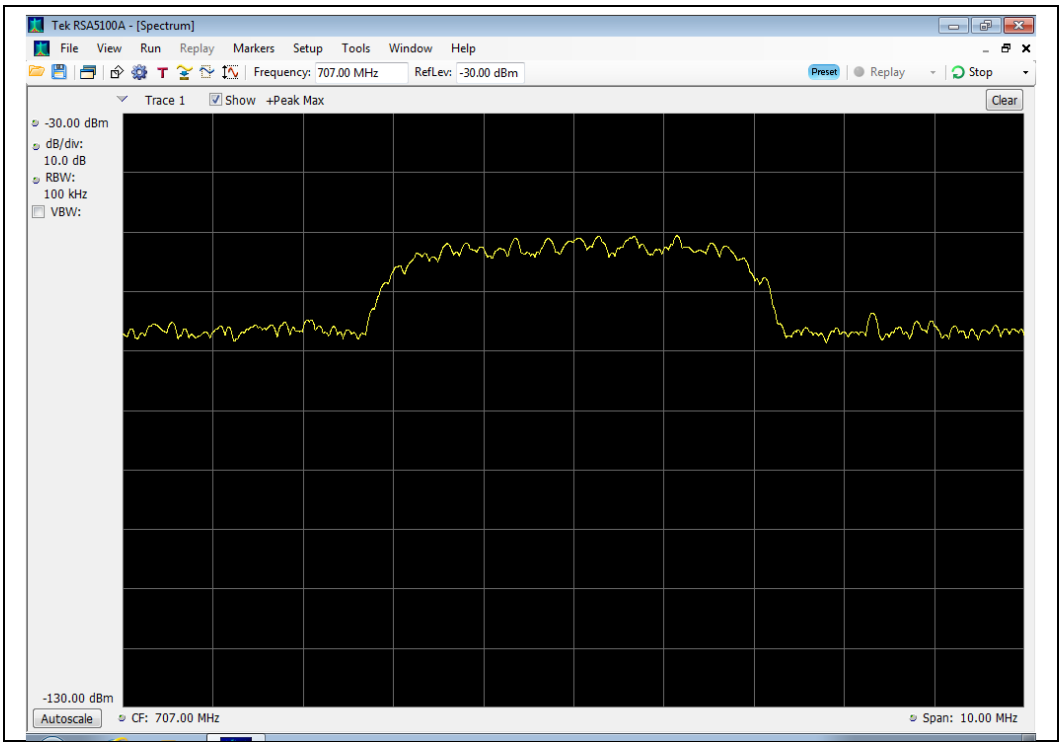
Output



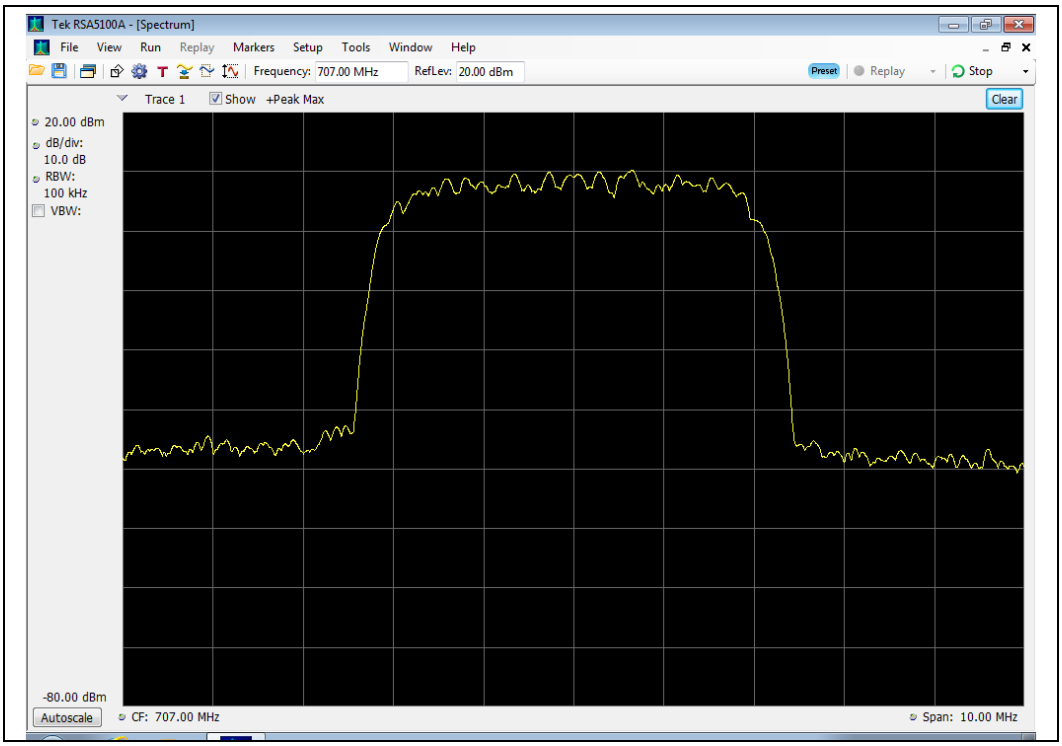
WCDMA Uplink Test Plots

698 - 716 MHz Band

Input

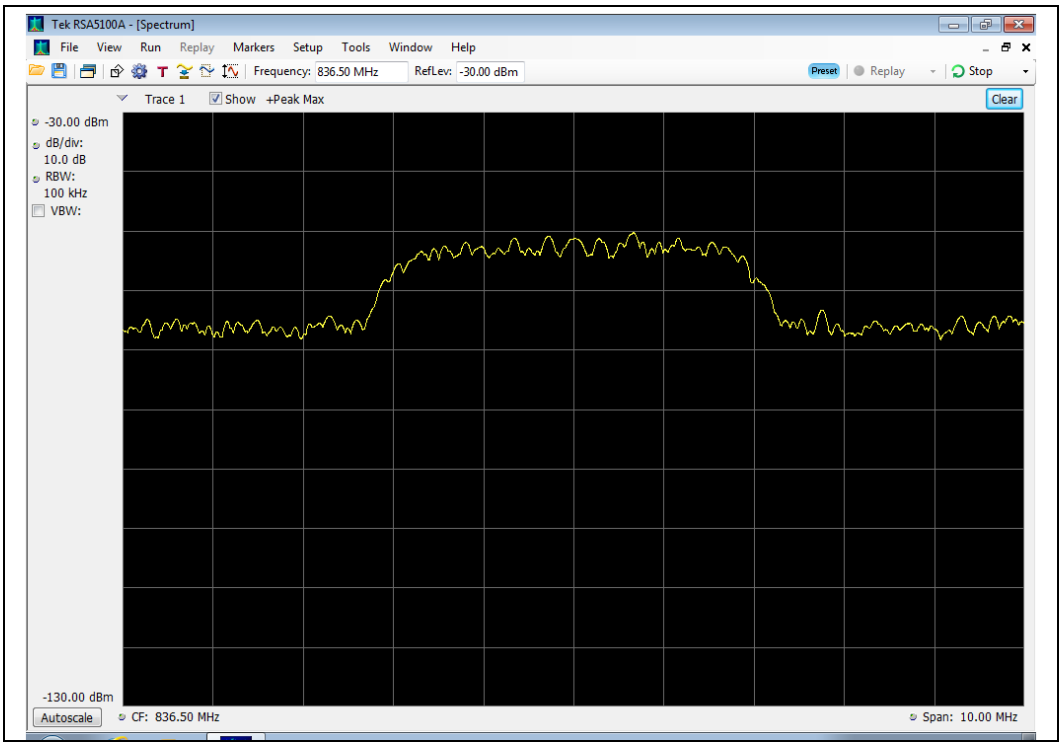


Output

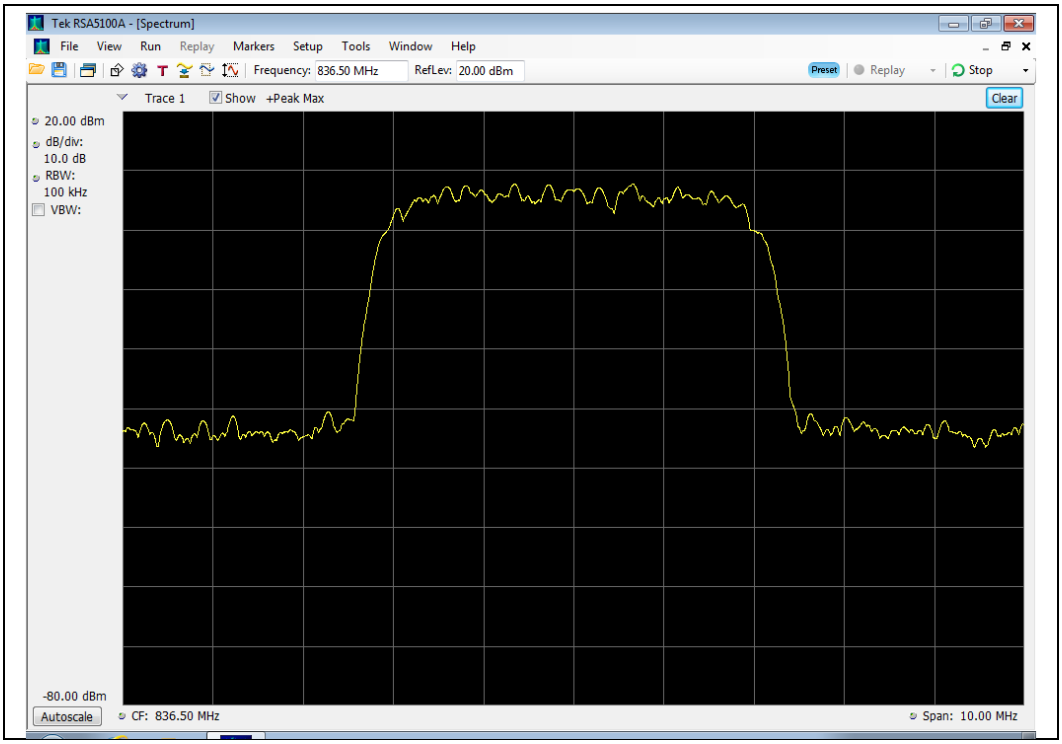


824 - 849 MHz Band

Input

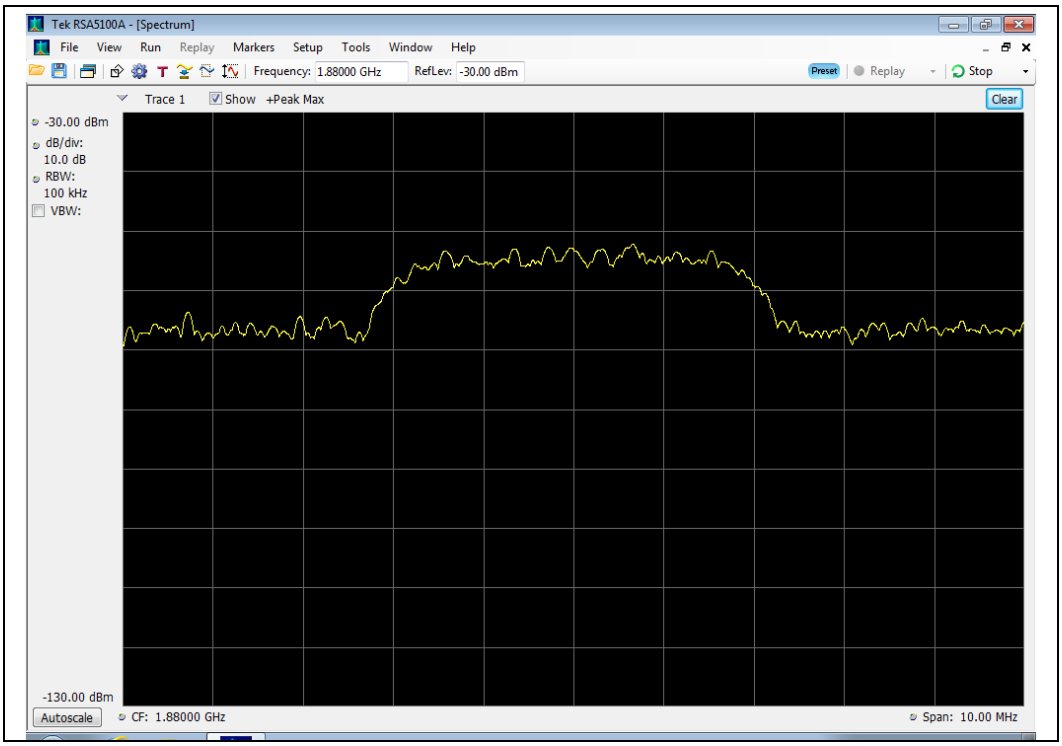


Output

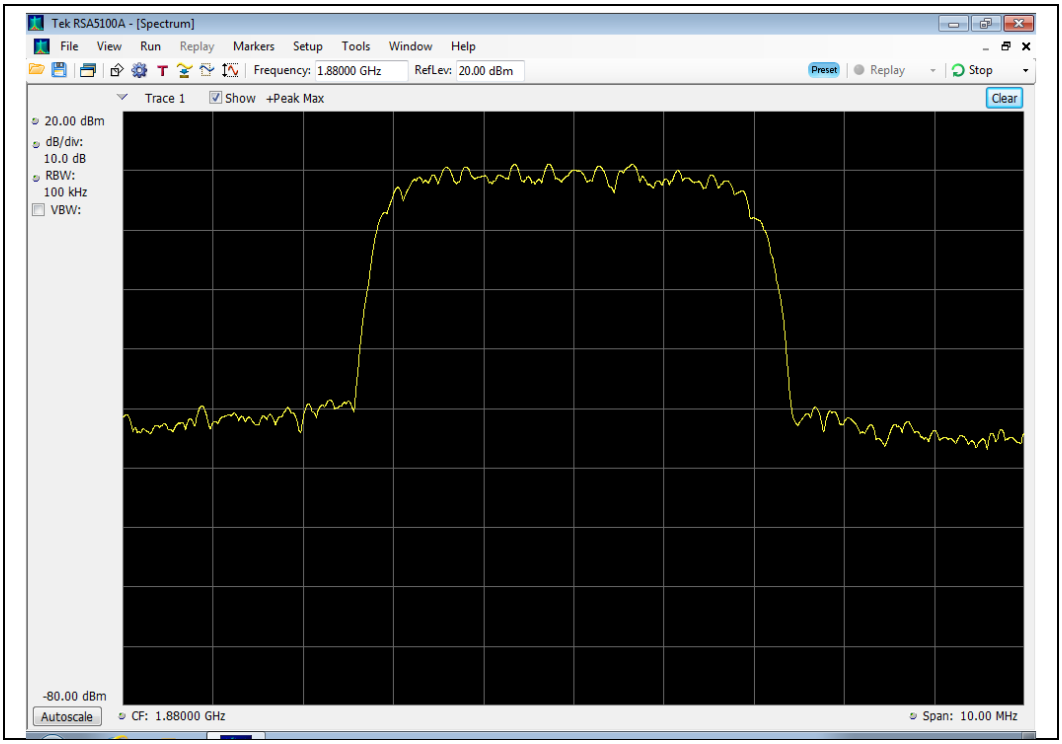


1850 - 1910 MHz Band

Input



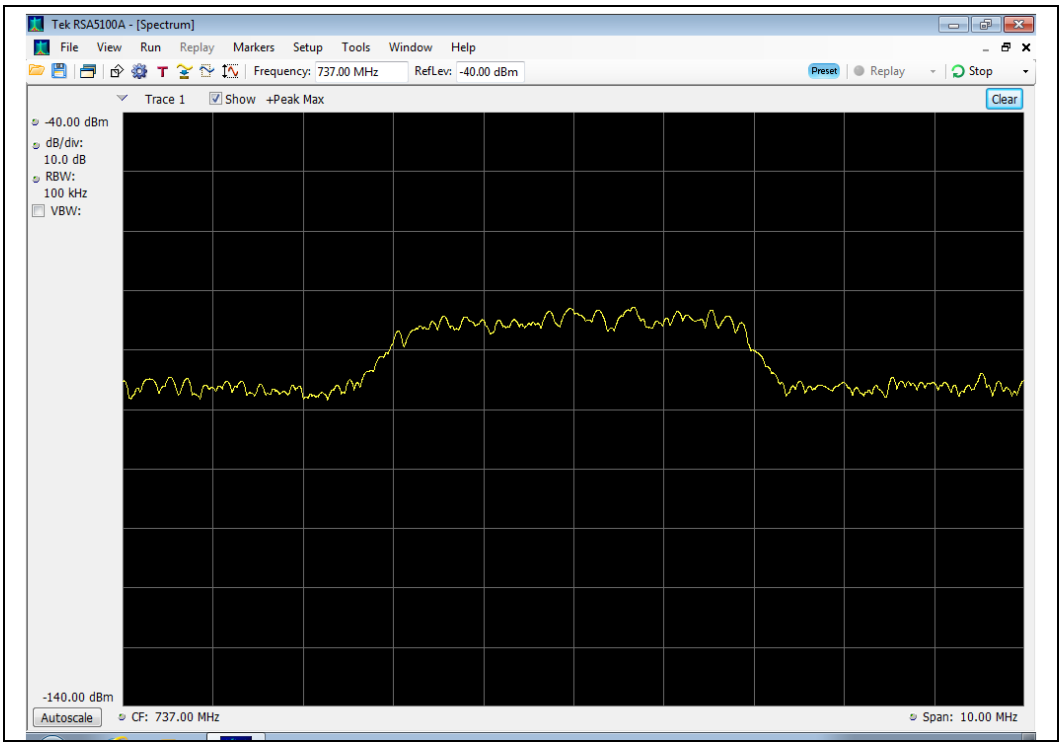
Output



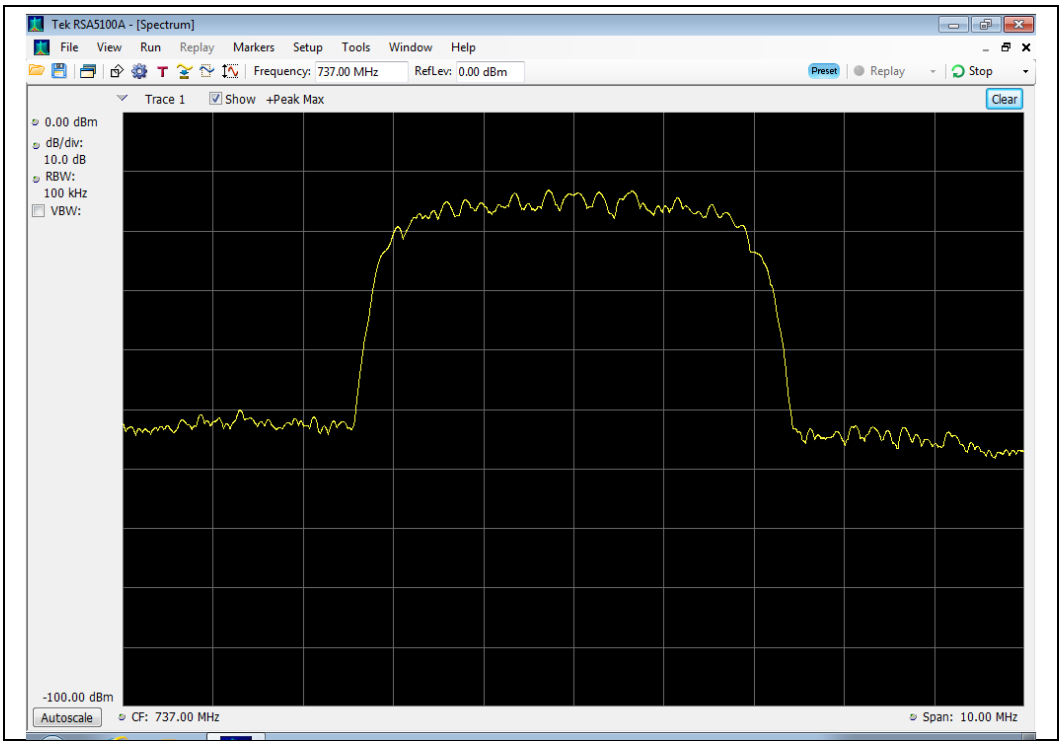
WCDMA Downlink Test Plots

728 - 746 MHz Band

Input

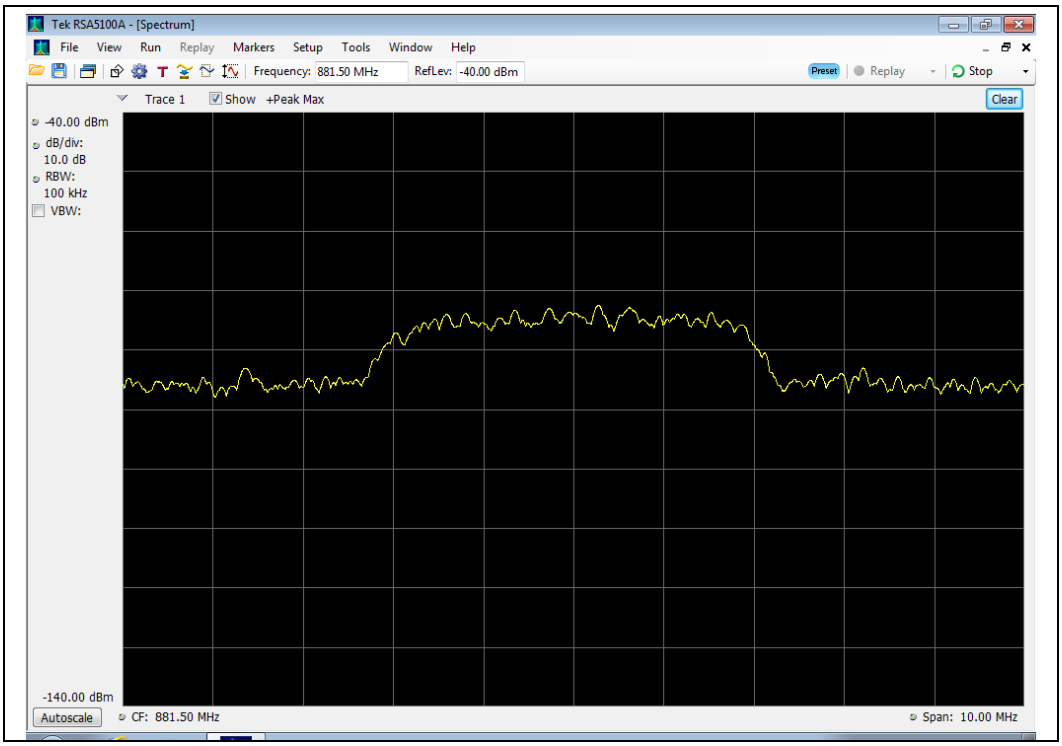


Output

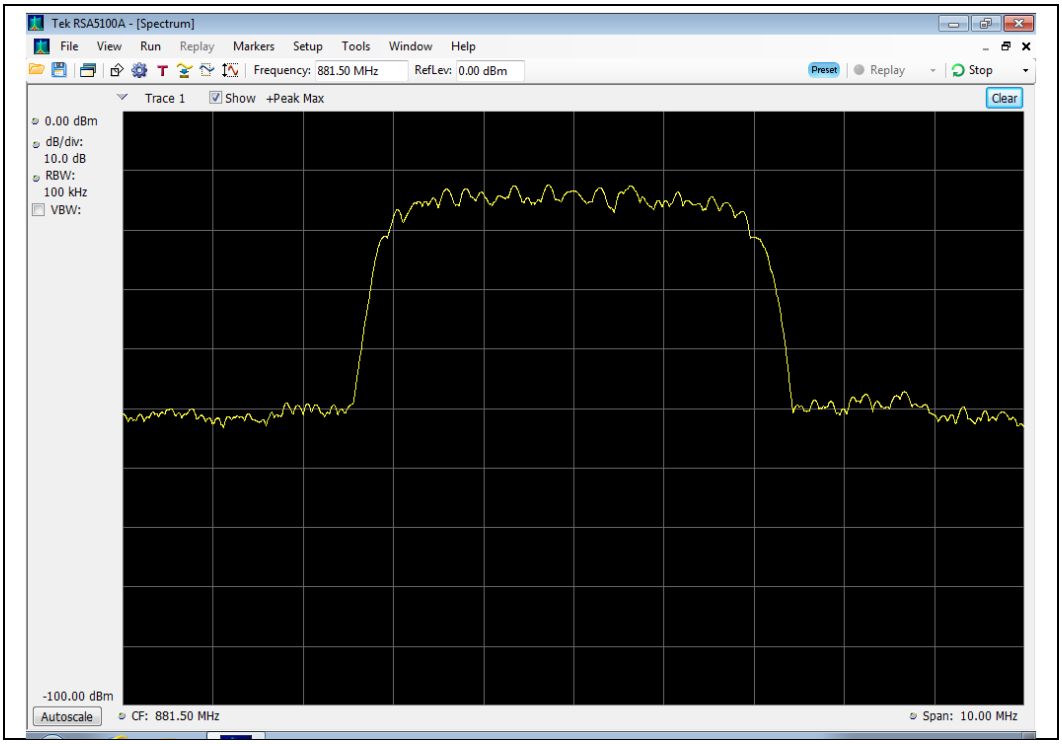


869 - 894 MHz Band

Input

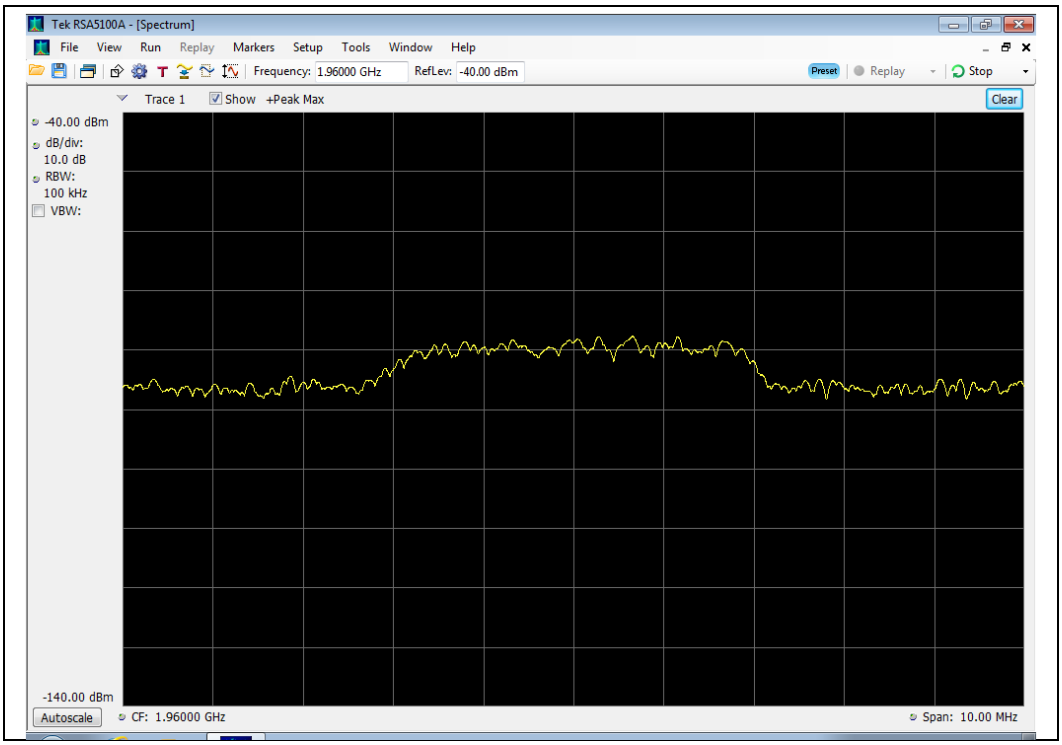


Output

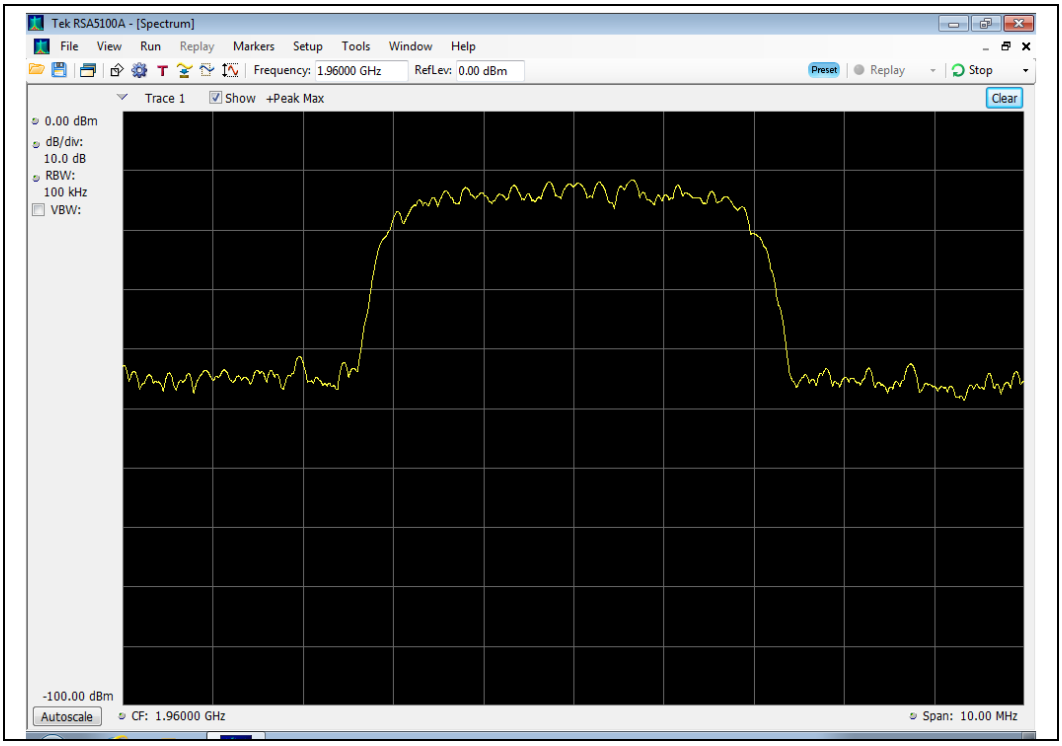


1930 - 1990 MHz Band

Input



Output



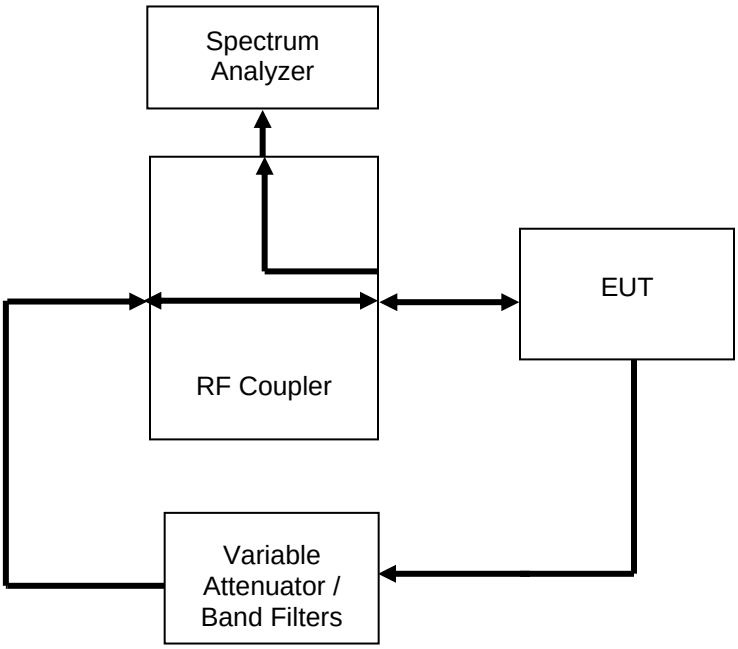
Oscillation Detection

Name of Test: Oscillation Detection **Engineer:** Greg Corbin
Test Equipment Utilized: i00411, i00413, i00424 **Test Date:** 11/26/2013

Test Procedure

The EUT was connected to a spectrum analyzer set for 0 Hz operation. The EUT uplink and downlink were fed back upon each other through a selectable band pass filter and variable attenuator. The EUT uplink and downlink were tested to ensure that the presence of oscillation was detected and that the EUT output turned off within 300 mS for the Uplink and 1 second for the Downlink and remained off for 1 minute. A EUT with test software was utilized to ensure that the EUT only had a maximum of 5 attempts at restart from oscillation before permanently shutting off.

Test Setup



Uplink Detection Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (mS)	Result
698 - 716	98.75	300	Pass
824 - 849	96.25	300	Pass
1850 - 1910	91.25	300	Pass

Downlink Detection Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (S)	Result
728 - 746	17.5	1	Pass
869 - 894	15	1	Pass
1930 - 1990	22.5	1	Pass

Uplink Restart Time Test Results

Frequency Band (MHz)	Measured Time (S)	Limit (S)	Result
698 - 716	68.125	≥60	Pass
824 - 849	68.25	≥60	Pass
1850 - 1910	68.5	≥60	Pass

Downlink Restart Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (mS)	Result
728 - 746	68.375	≥60	Pass
869 - 894	68.5	≥60	Pass
1930 - 1990	68.5	≥60	Pass

Uplink Restart Count Test Results

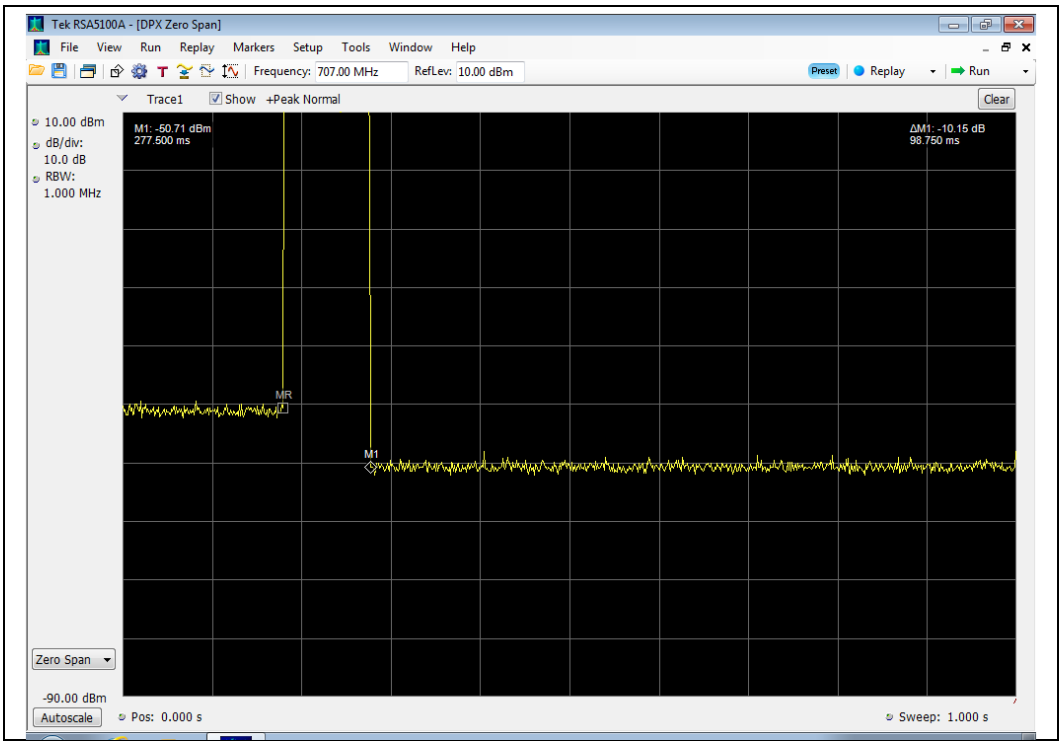
Frequency Band (MHz)	Restarts	Limit	Result
698 - 716	5	≤5	Pass
824 - 849	5	≤5	Pass
1850 - 1910	5	≤5	Pass

Downlink Restart Count Test Results

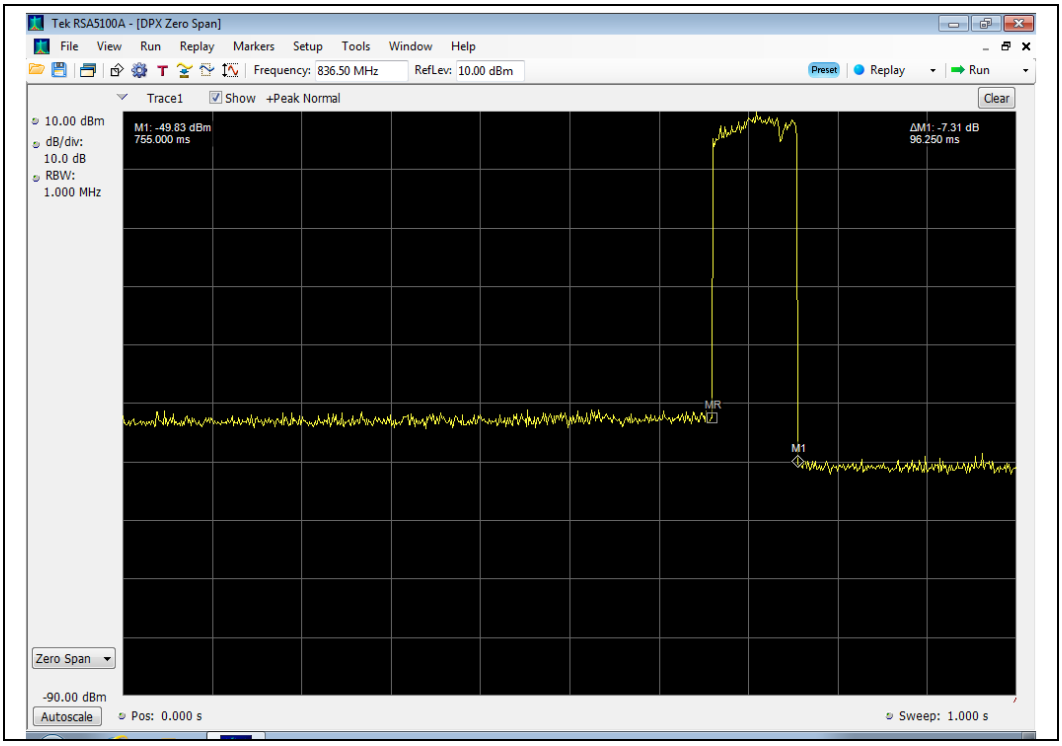
Frequency Band (MHz)	Restarts	Limit	Result
728 - 746	5	≤5	Pass
869 - 894	5	≤5	Pass
1930 - 1990	5	≤5	Pass

Uplink Detection Time Test Results

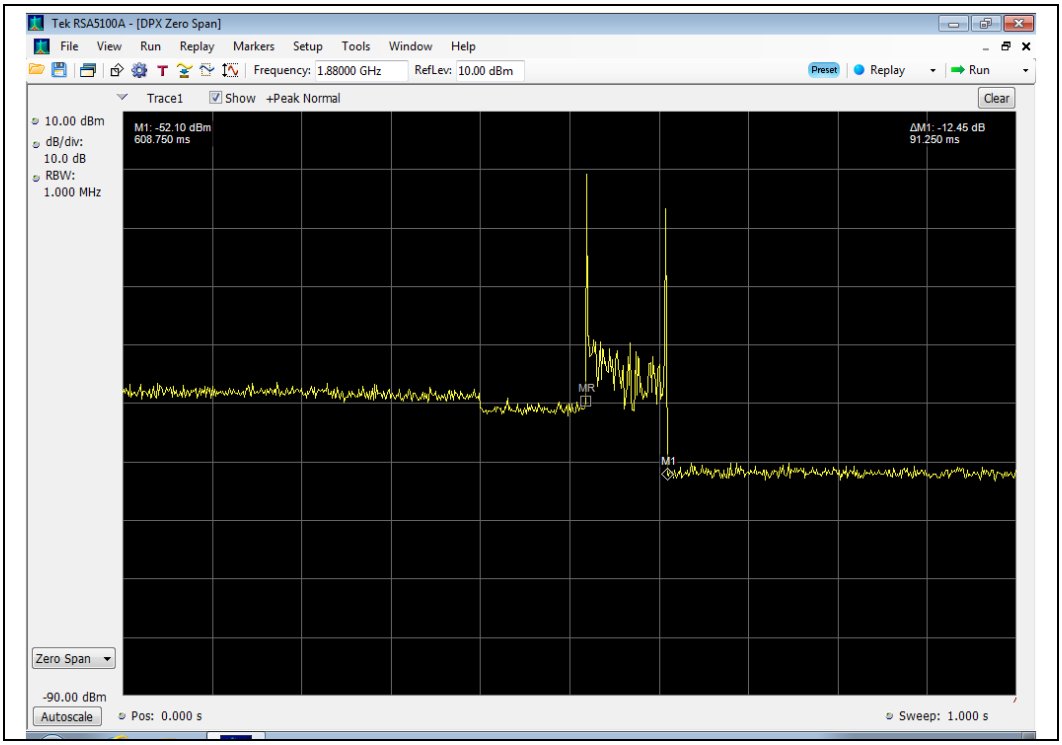
698 - 716 MHz Band



824 - 849 MHz Band

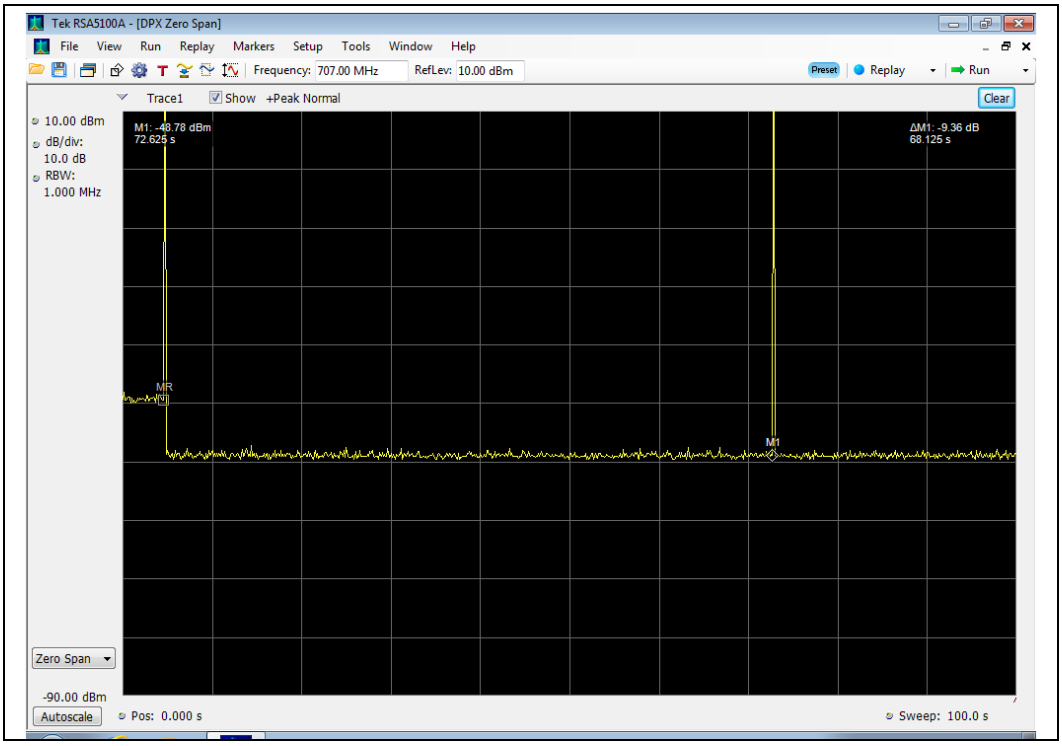


1850 - 1910 MHz Band

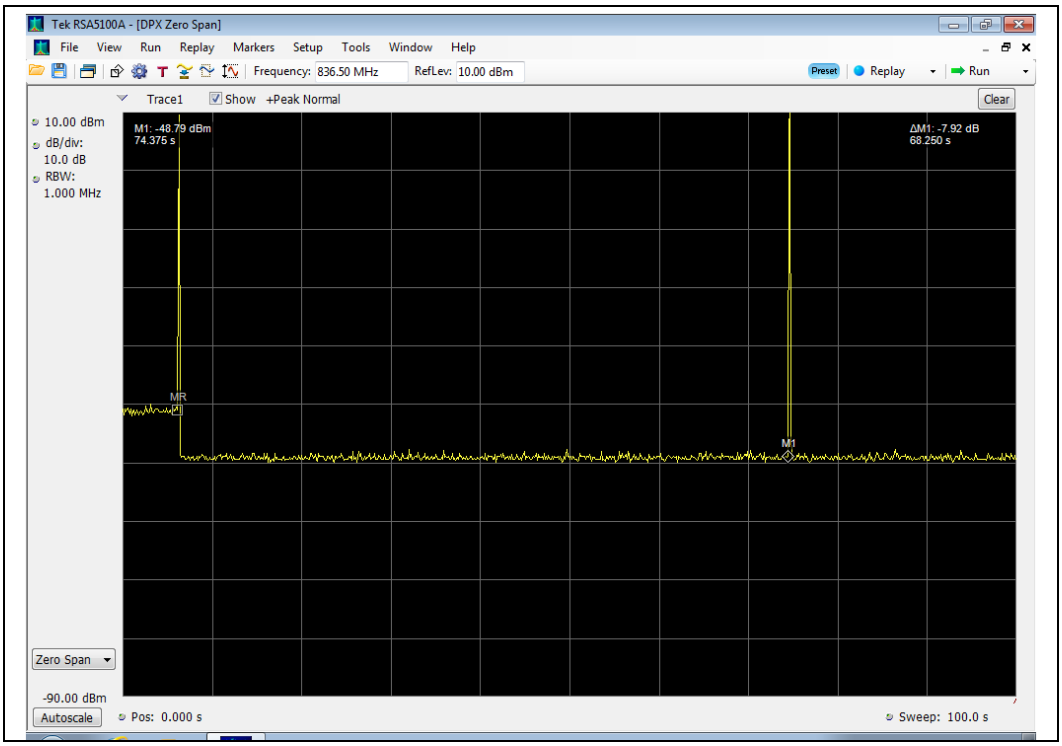


Uplink Restart Time Test Results

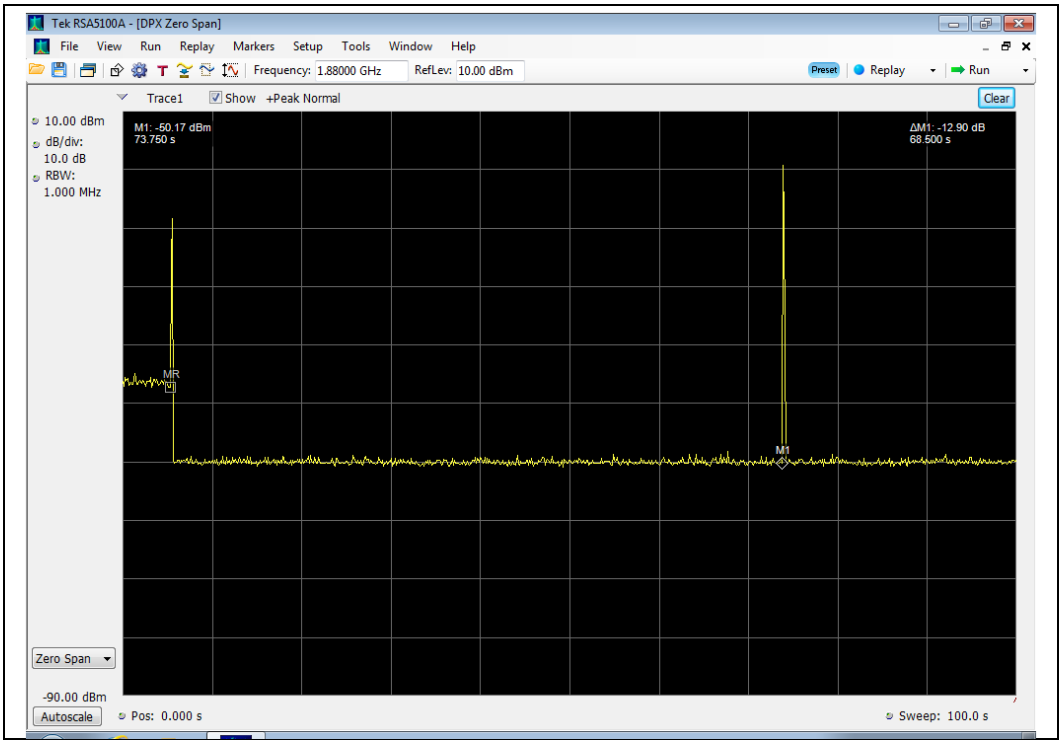
698 - 716 MHz Band



824 - 849 MHz Band

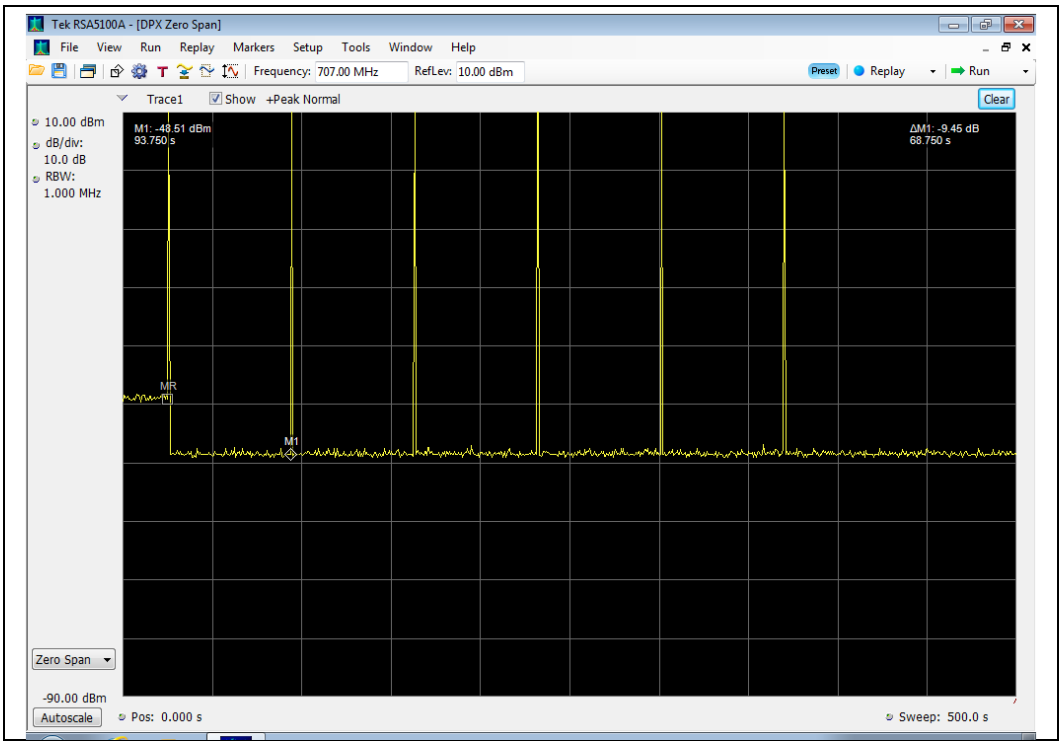


1850 - 1910 MHz Band

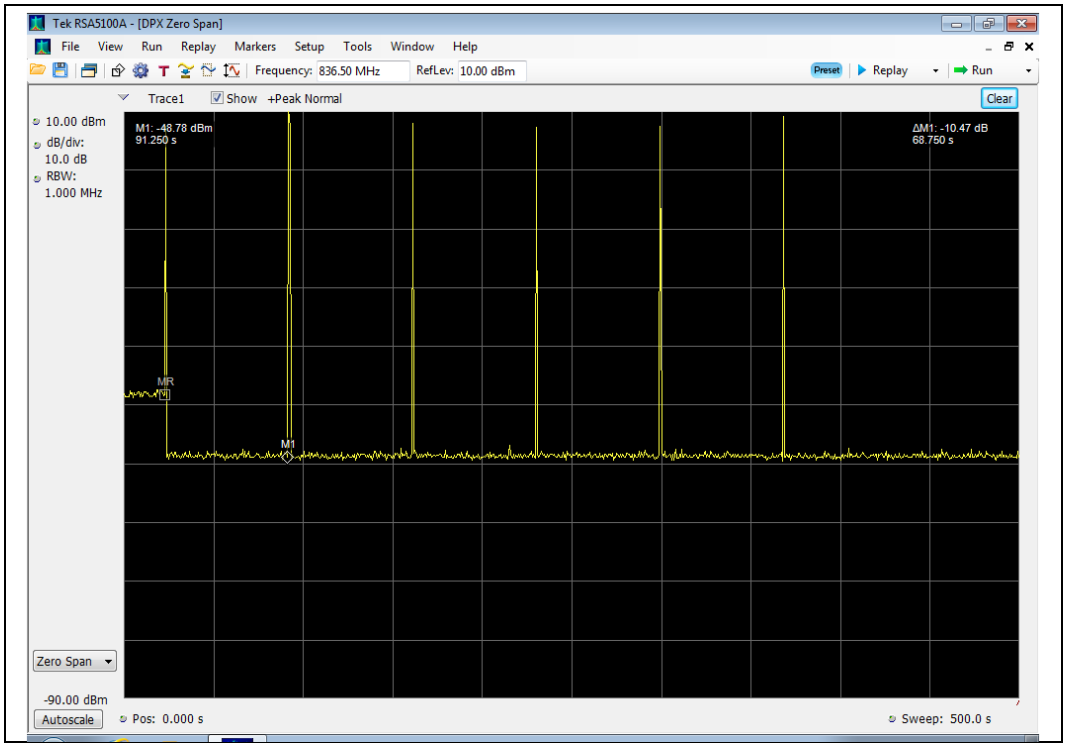


Uplink Restart Count Test Results

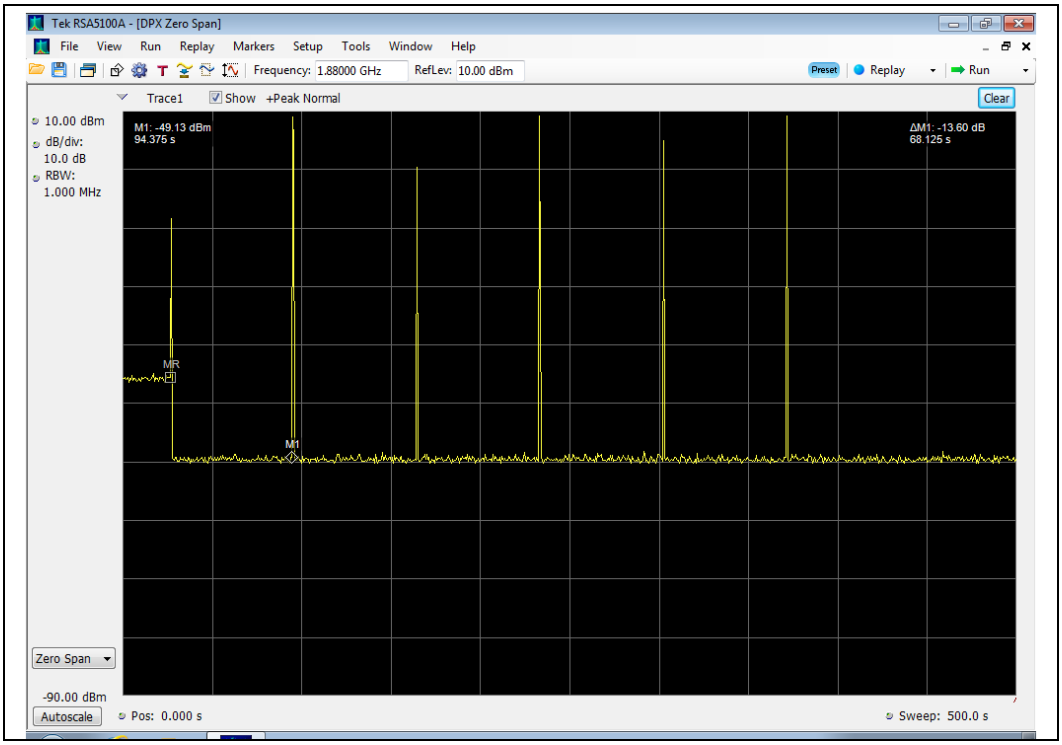
698 - 716 MHz Band



824 - 849 MHz Band

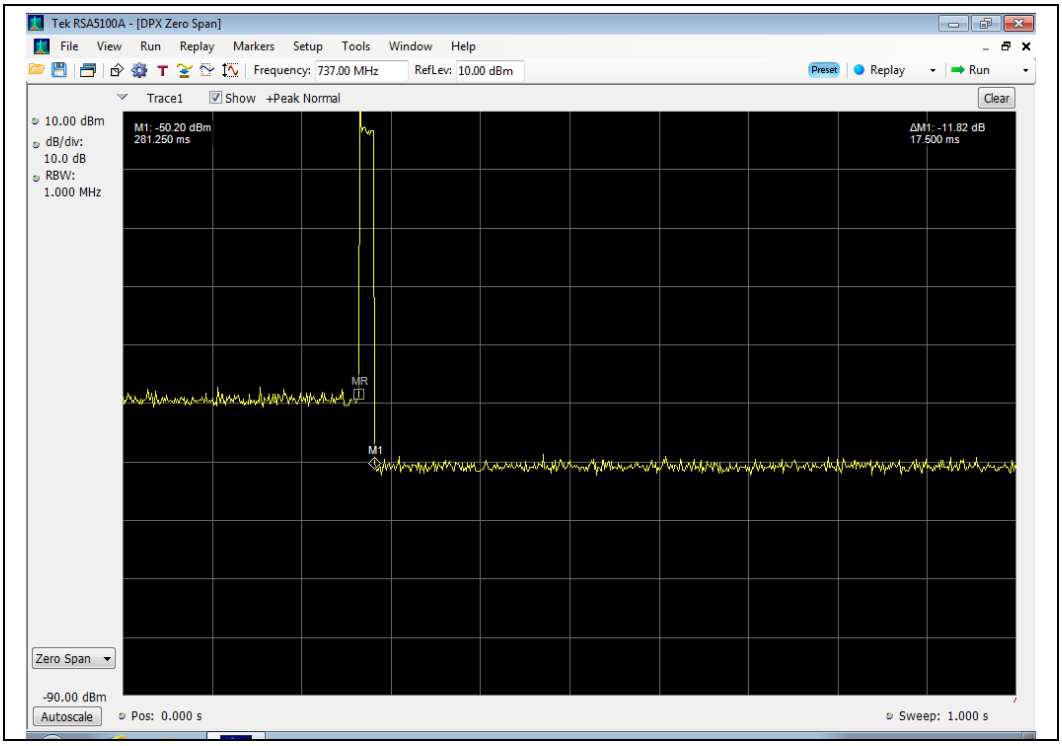


1850 - 1910 MHz Band

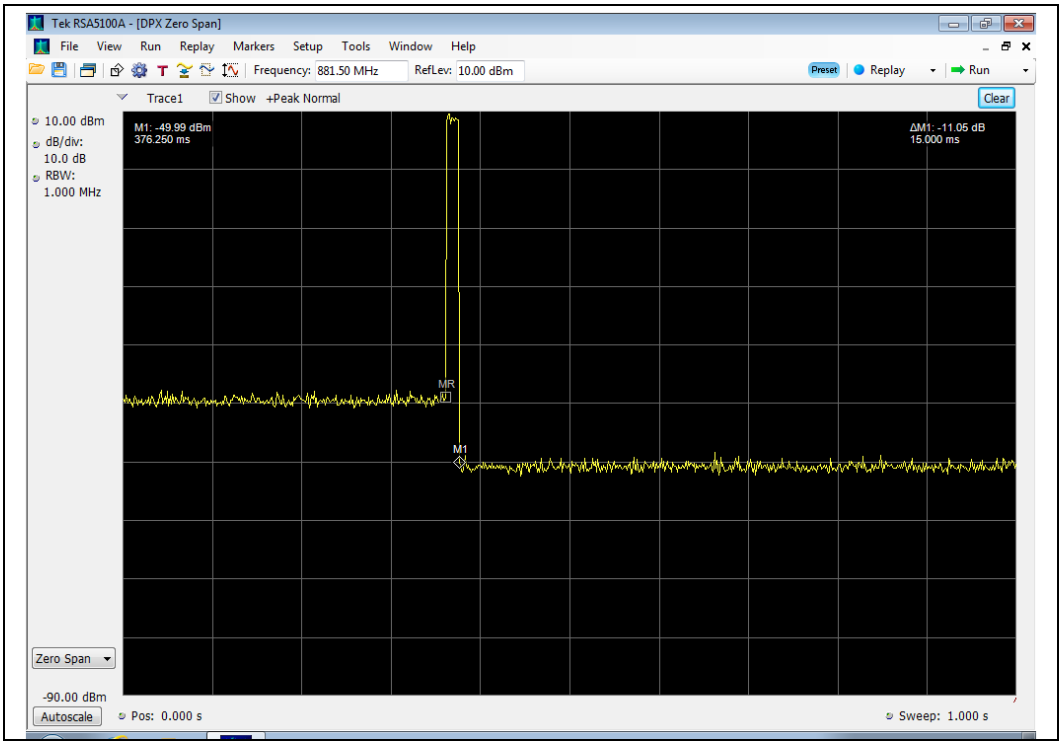


Downlink Detection Time Test Results

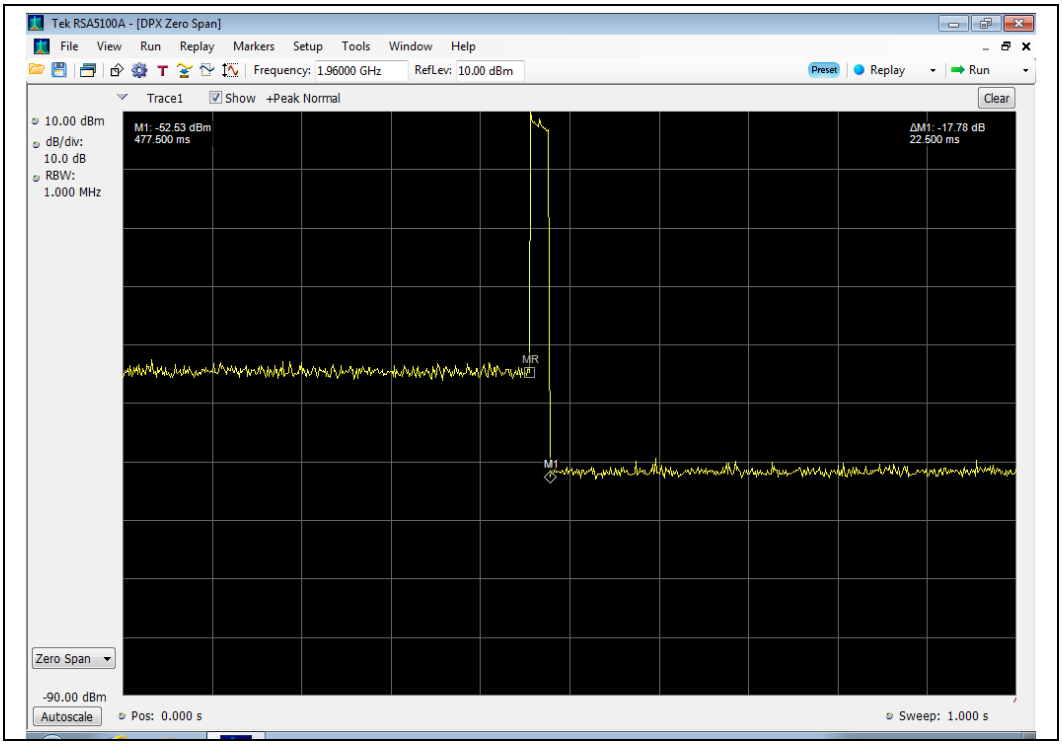
728 - 746 MHz Band



869 - 894 MHz Band

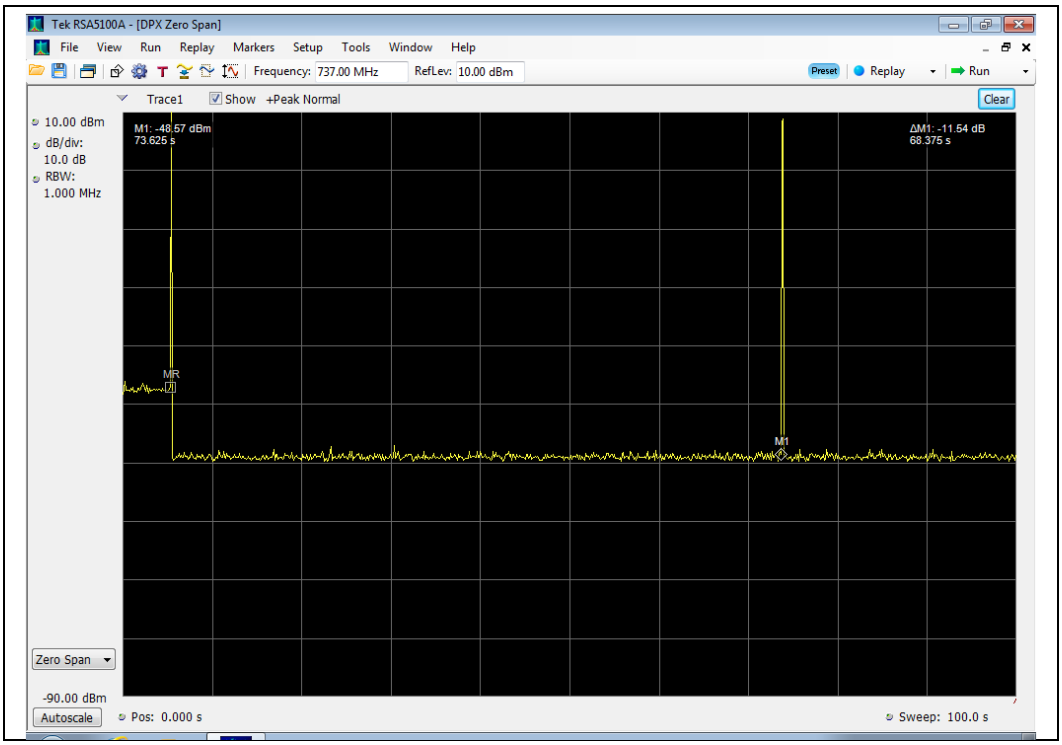


1930 - 1990 MHz Band

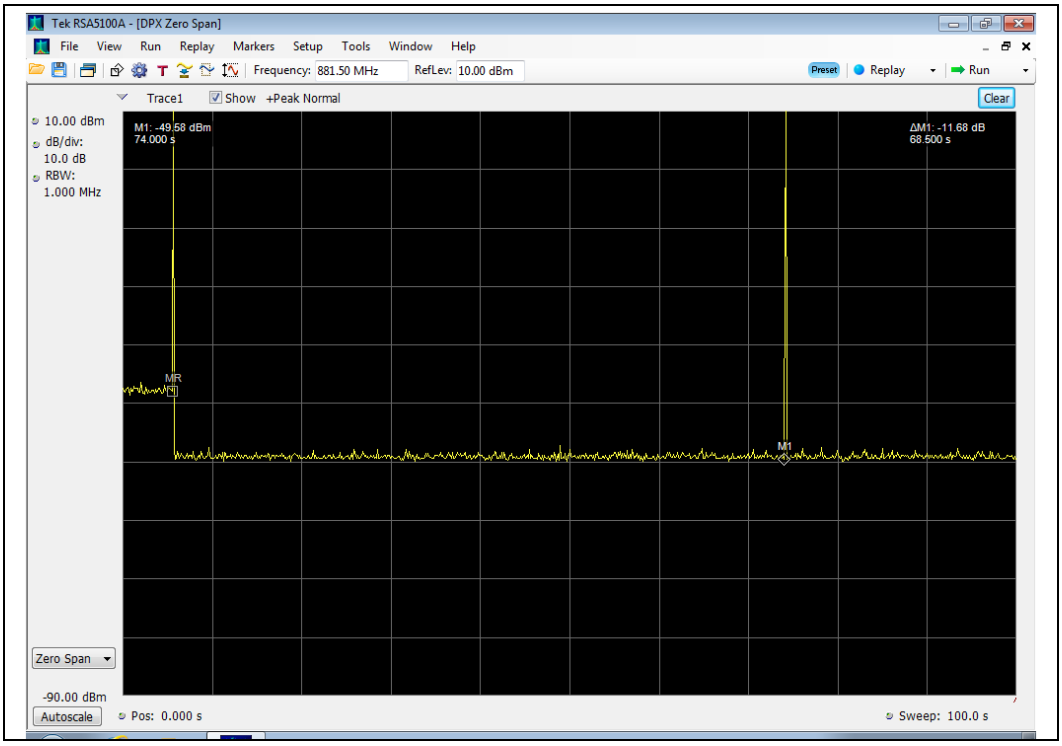


Downlink Restart Time Test Results

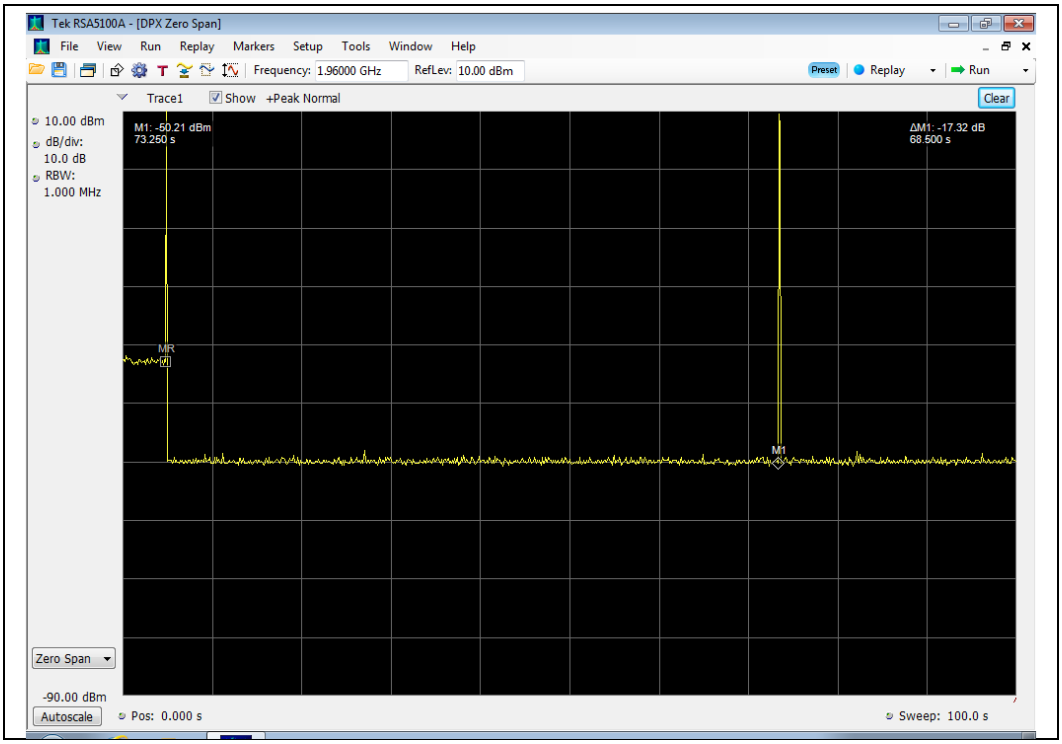
728 - 746 MHz Band



869 - 894 MHz Band

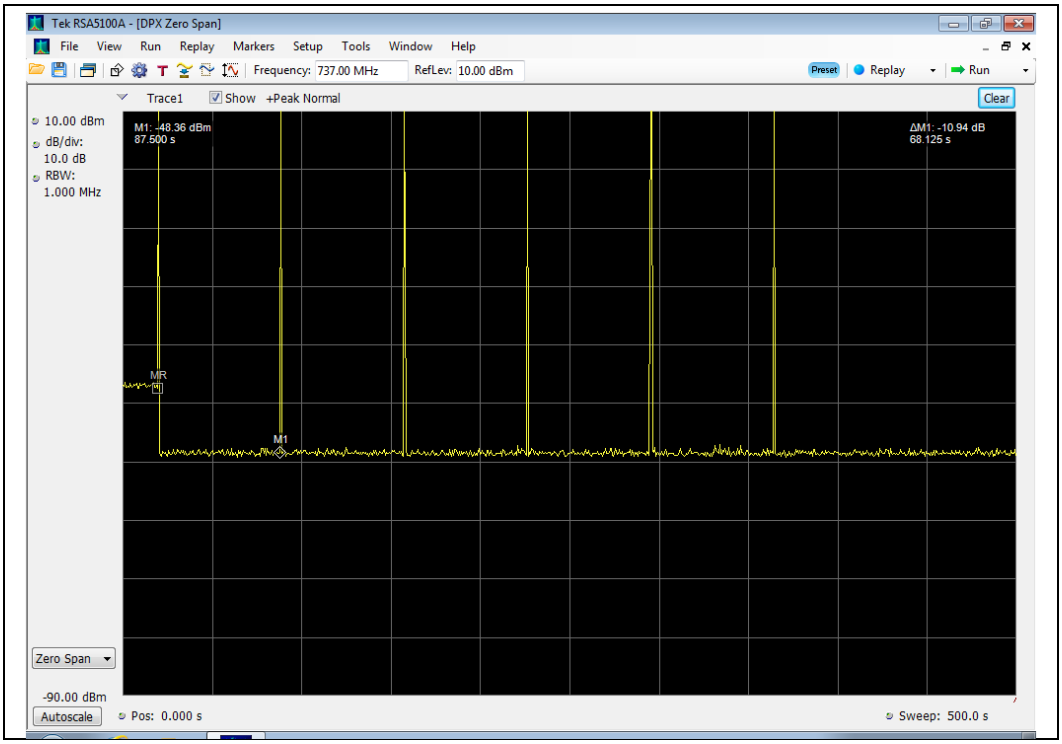


1930 - 1990 MHz Band

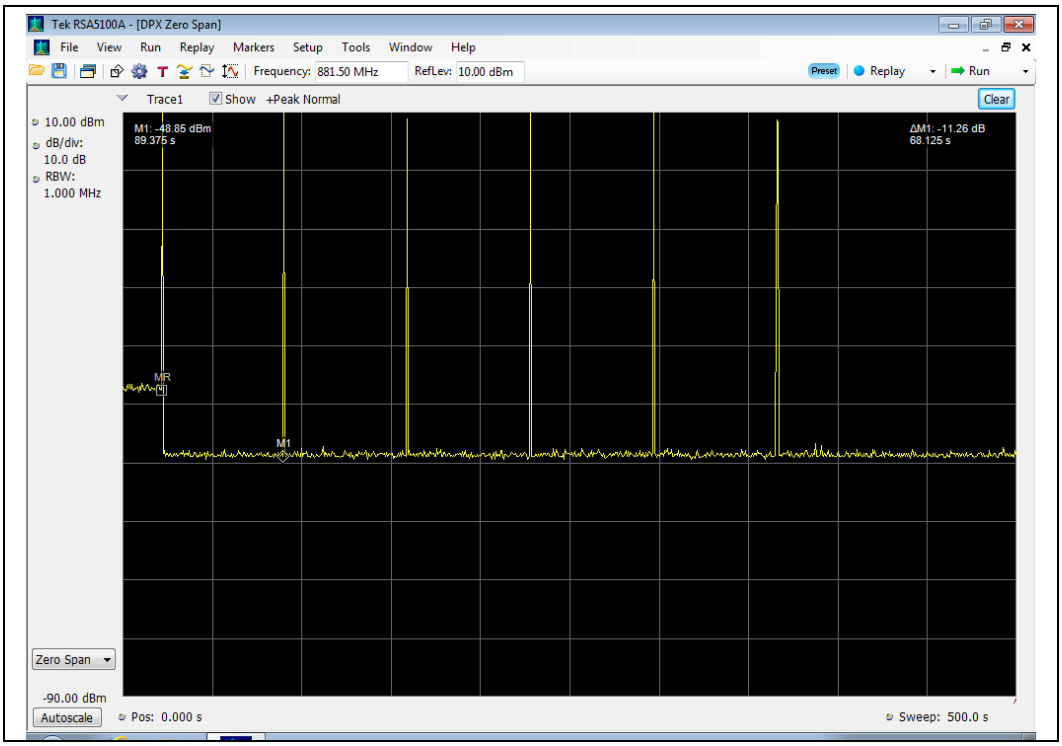


Downlink Restart Count Test Results

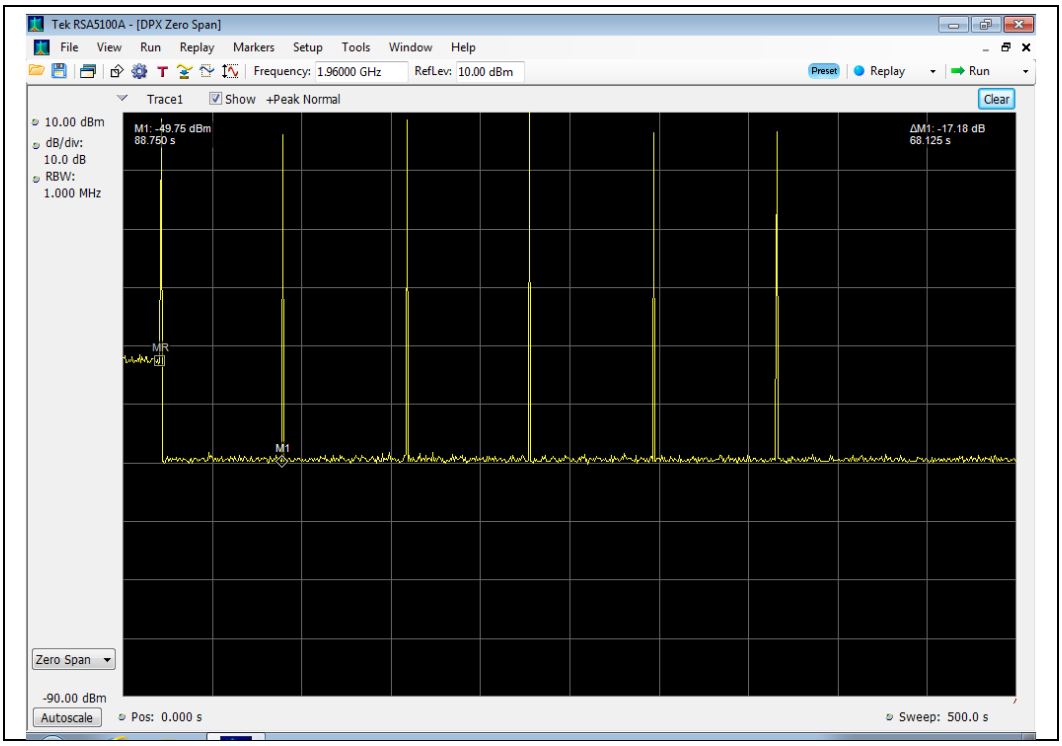
728 - 746 MHz Band



869 - 894 MHz Band



1930 - 1990 MHz Band



Radiated Spurious

Name of Test:	Radiated Spurious	**Engineer:**	Greg Corbin
Test Equipment Utilized:	i00103,i00334, i00379, SMU 200A - S/N:101369	**Test Date:**	12/8/2013

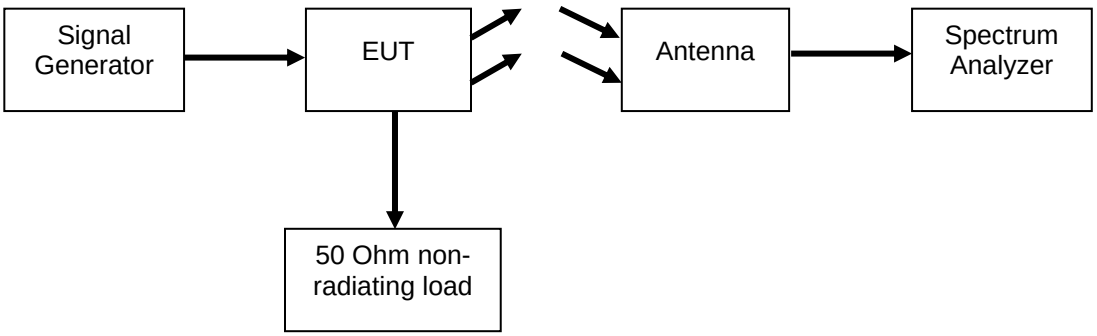
Test Procedure

The EUT was tested in an Open Area Test Site (OATS) set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure that the signal levels were maximized. All cable and antenna correction factors were input into the spectrum analyzer ensuring an accurate measurement in ERP/EIRP with the resultant power in dBm. A signal generator was used to provide a CW signal centered in each operational uplink and downlink band. The EUT output was terminated into a 50 Ohm non-radiating load.

The following formula was used for calculating the limits:

Radiated Spurious Emissions Limit = P1 – (43+ 10Log(P2)) = -13dBm
P1 = power in dBm
P2 = power in Watts

Test Setup



Uplink Test Results

698 - 716 MHz Band_707 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1414	-48.1	-13	Pass
2121	-42.2	-13	Pass
2828	-38.4	-13	Pass

824 - 849 MHz Band_836.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1673	-44.5	-13	Pass
2509.5	-40.8	-13	Pass
3346	-40.0	-13	Pass

1850 - 1910 MHz Band 1880 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3760	-35.7	-13	Pass
5640	-32.1	-13	Pass
7520	-25.2	-13	Pass

Downlink Test Results

728 - 746 MHz Band 737 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1474	-46.6	-13	Pass
2211	-42.9	-13	Pass
2948	-37.7	-13	Pass

869 - 894 MHz Band 881.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1763	-45.3	-13	Pass
2644.5	-39.3	-13	Pass
3526	-36.8	-13	Pass

1930 - 1990 MHz Band 1960 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3920	-36.0	-13	Pass
5880	-33.1	-13	Pass
7840	-25.5	-13	Pass

No other emissions were detected.
All emissions were lower than –13 dBm.
All emissions were system noise floor.

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	EMCO	3115	i00103	12/11/2012	12/11/2014
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	12/4/12	12/4/13**
Voltmeter	Fluke	75III	i00320	2/1/13	2/1/14
Non-radiating load	Termaline	8201	i00334	Verified on: 12/8/2013	
EMI Analyzer	Agilent	E7405A	i00379	11/21/12	11/21/13**
Tunable Band Pass Filter	Wilson Electronics	Variable attenuator / Bandpass Filter Switch Assembly	i00411	Verified on: 11/26/2013	
RF Directional Coupler	Meca	CS06-1.500V	i00413	Verified on: 11/26/2013	
Signal Generator	Rohde & Schwarz	SMU200A	S/N:101369	6/24/13	6/24/16
Spectrum Analyzer	Textronix	RSA5126A	i00424	9/22/13	9/22/14

** - Equipment calibration extended for 30 days.

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT